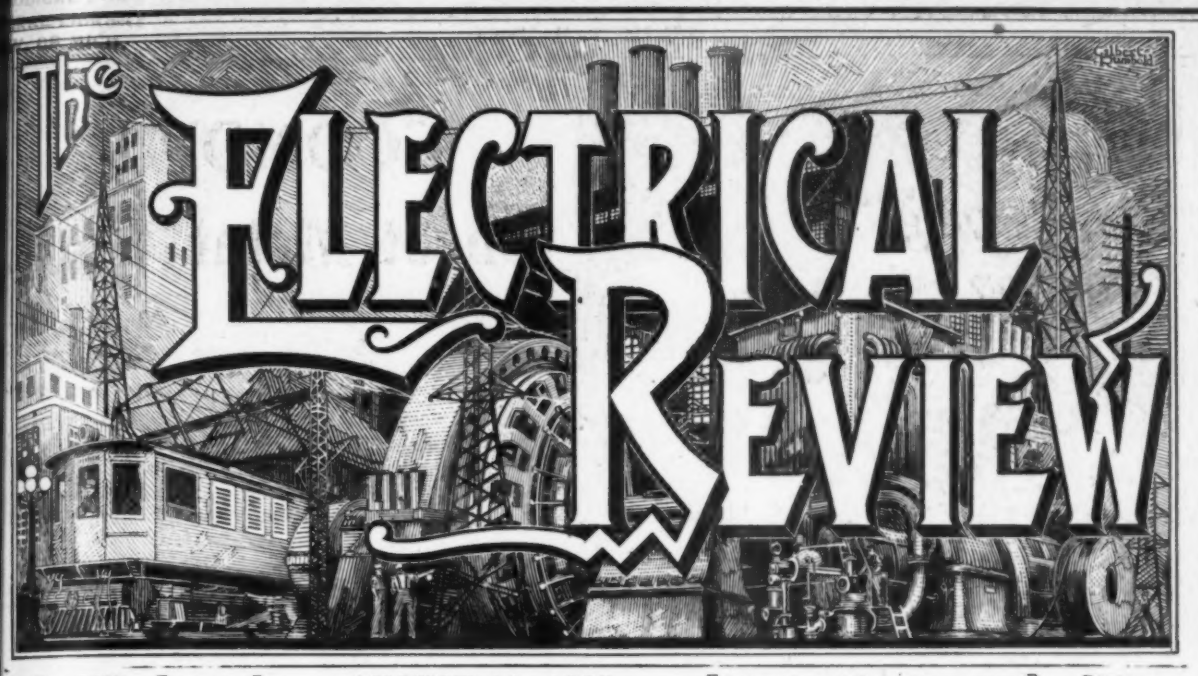

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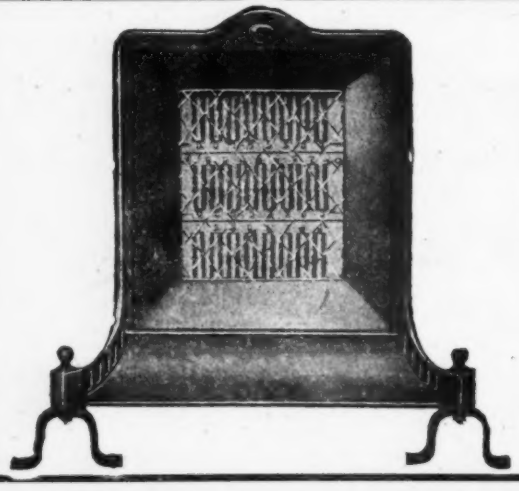

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A FRIENDLY BASIS FOR TRADE.

To view the future with fortitude is to clear away half its difficulties. Under present circumstances, however, the weight of taxation, the baffling influence of the exchanges, the debasement of the coinage, and the absence of any tangible policy in Europe of a constructive character, induce a sense of instability and discouragement calculated to defeat even the most optimistic and courageous. Nevertheless the flag must be kept flying, and the task of restoring the balance of trade, credit, and the Imperial idea must be boldly taken in hand. Where does that task begin? So intimately are cause and effect linked together that the whole situation can only be represented as a vicious circle, a whirl of sand and blood. Under circumstances of this kind, where confusion reigns, and facts and lies appear and disappear like bubbles in a cauldron, it is usually best to concentrate first upon the human element and thus to localise the trouble.

A group of politicians who, presumably, have special means of ascertaining the condition of home affairs, assert that the gravity of the present position with regard to unemployment cannot be exaggerated, that national vitality is at stake, and that we are approaching the fourth winter of unemployment with the cumulative effect of the last three winters. A commentary upon this is a White Paper which has just been issued stating that the cost to the Exchequer, of works assisted on the basis of 60 per cent. of the wages bill in respect of loans sanctioned for enterprises to meet the threatened disemployment, amounts to about £14,000,000, to be spread over a period of sixteen years, in respect of total loans of £30,000,000. In principle, a scheme that is to give increased facilities for the electrification of railways and for developing telephone trunk-lines deserves every support and encouragement. At the same time it is essential that the reflex action of such official generosity should be kept in mind. The vast municipal and public debt and the ever-increasing burden of loans must not be left out of account. In particular, the terms of such arrangements require to be independently examined to ensure that they do not enhance the difficulties of traders in general with regard to costs of labour and material. Above all, it is necessary to realise that restoration depends ultimately upon successful competition in the markets of the world, and that any policy that maintains costs of labour or material in excess of what can secure orders in open competition must defeat itself in detail. The threat of unemployment, therefore, must not be allowed to be used too freely by the Ministry of Health as a means of creating debt that masquerades as wealth.

There are two aspects of the problem of vanishing trade. The first relates to the closing of markets against British goods from causes other than mere price; and the second to instances where our goods and services are automatically excluded because our prices exceed the economic limit. This second condition of affairs is not restricted to overseas trade; it is in evidence at home in the housing problem and in other important

industries. Everybody knows the cure for it, but it is an unpleasant matter, and the cure is slow and painful. Lower wages, a corresponding reduced scale of profits, and a getting together on a friendly basis of employer and employed would surmount some of the troubles of the present moment, and would offer the best chance for stability in wages and a correspondingly increased scale of profits in the future. Thoughts of war efforts, Whitley Councils, peace sentiments, and other angelic corridors paved with good intentions, naturally occur to the mind as having been tried with only partial success. Nevertheless we hold to the belief that friendly negotiation between masters and men will be the way by which Great and Greater Britain will get back into its stride.

Let us approach the matter from yet another standpoint and observe the remarkable decrease that has occurred since the armistice in the aggregate membership of trade unions. From 1913 to the end of the war the membership practically doubled itself. With the discontinuance of special work upon armaments it was natural that there should be a decline corresponding to the return to normal conditions. Some accessions were to be expected from demobilised men from the Navy, the Army, and the Air Force, and these may fairly have been counted upon to prevent a violent decline. As a matter of fact the numbers actually increased between the years 1919 and 1920 by more than 400,000. They fell rapidly thereafter, however, and the reasons assigned for this were lack of confidence in leaders, unemployment, and inability of the unions to obtain for members further increases in wages.

It would be exceeding the proper inference from the evidence to assume that members of trade unions, in the aggregate, represent more that a section of the workpeople of the country. Regarding them as a large and important section, this phase of the history of the movement is profoundly disappointing. That their numbers have fallen back is, in itself, only the natural consequence of the return to pre-war conditions. With better leadership, and with higher ideals than are revealed by the facts, however, there was every chance for such an organisation to maintain its numbers and to improve its status. It might have constituted exactly the kind of body needed at the present juncture to adjust the equipoise. They must be held to have failed, owing to the absence of the qualities that make for success in team work, and because of a wrong outlook on the affairs of the country and the Empire as a whole.

We must try again. The trading difficulties of the Empire cannot be surmounted without organisation, and there cannot be organisation unless there is something equivalent to discipline and control. This time let it be a friendly organisation. The antagonistic variety has hopelessly failed. It was class against class. That there must be at least two classes is manifest; but that there must be war between classes is a fundamental mistake. "The worst thing of all," said a great Englishman in a great age, "is the apotheosis of error." As before in the history of a stricken Europe, Britain must take the lead, and it would do well to begin by abandoning the error that assumes the inherence of class antagonism. Study of humanity shows that an organisation can only be kept in existence by a motive force, and that this force must be either benevolent or malevolent. Trade unions have declined because they made a wrong selection. We must try again.

Insulating Joints in Cables.

Cables are buried in the ground, and should thereafter give no sign of their existence—save that of the silent service which they render; like the happy nation that has no history, the cable that is never disinterred represents the ideal. Continuity of service is of pre-eminent importance to the industry of electricity supply, seeing that upon it depends the continuity of employment of millions of workers and the economic utilisation of the capital expended upon factories and plant. Duplicating mains reduces the risk of interruption, but does not remove it, and the same is true in degree of any number of alternative avenues of supply; but fortunately in the art of cable manufacture, this country leads the world, and our cable makers are prepared to-day to supply cables for any pressure up to 66,000 volts, with confidence that they will stand up to their work as surely as their predecessors at lower voltages.

But the strength of a chain is that of its weakest link; and cables, unfortunately, must have joints. When an underground cable does break down, nine times out of ten the failure is at a joint, and until the art of making joints in cables is on a par with that of making the cables themselves, the supply engineer will never enjoy the dreamless sleep of him who has no joints to worry about. A single feeder cable may supply an area of ten square miles, twenty miles away from the power station, and may have hundreds of joints in its length, any one of which may harbour a flaw destined some day to interrupt the service. Hence any advance in the art of jointing may well be hailed with joy, and we believe that the exceedingly clever device which we describe elsewhere in this issue will receive a hearty welcome from mains engineers as a real step forward. While it obviously does not remove all the sources of weakness of a joint, it certainly provides an excellent first line of defence at the very weakest spot, and we hope that the claims that have been made for it will be fully substantiated by further experience.

London's Electricity Supply.

If any further evidence is needed of the multitudinous interests which have to be reconciled before the reorganisation of London's electricity supply can be accomplished, it is provided by the latest report issued by the L.C.C. dealing with the matter, which is summarised elsewhere in this issue. The number of companies and municipalities supplying electricity in the Greater London area is now 85, an addition of one since the last report. No mention is made of the many systems of supply in vogue, but there are 21 methods of charging employed, each with its different prices—too widely different in many instances.

In the meantime, the preliminaries to the reorganisation have (shall we say) advanced in the last fortnight. The decision of the Court of Appeal recorded in our last issue has left the matter of the Commissioners' Draft Order "in the air." A rule for prohibition obtained by the London companies against the Commissioners has been made absolute, and it would appear that, unless this is altered by the House of Lords (if the matter is taken there), the Commissioners will have to make considerable modifications in the Order.

They will no doubt be assisted in this by the report of the Special Committee on London Electricity Supply which was adopted by the London County Council last week. This, as will be seen from the abstract elsewhere in this issue, proposes a long extension of the companies' tenure, but puts them under the control of the Joint Electricity Authority in four important matters. The first of these sections binds the companies to proceed with development according to the general scheme of the Authority, and, if adopted, would secure that the growth of the heterogeneous system in all directions, as at present, would be checked and progress guided into some sort of uniformity. Thus, one of the chief aims of the latest Electricity (Supply) Acts would be met. The regulation of prices and dividends is one of the preliminaries, and thus another point of importance is provided for.

As the companies do not appear to have been hostile to the proposals, it is possible that we may see a settlement of the great problem upon the lines of the report.

We have yet to hear, however, the views of the Conference of Local Authorities owning Electricity Undertakings in Greater London, and those of the Commissioners themselves. The Committee is sanguine in its hopes, and if we have any feeling in the matter, it is that we would rather see any settlement than the continuance of the present uncertainty and delay.

Electricity In Factories.

Mr. G. Scott Ram's chapter of the annual report of H.M. Chief Inspector of Factories and Workshops for 1922, an abstract of which is commenced elsewhere in this issue, indicates that much useful work has been accomplished during the year by the four Divisional Electrical Inspectors. Their reports on the year's work contain much valuable information and important matter of general interest, but of which space does not allow of even a brief summary.

It is satisfactory to be able to record a reduction in the number of accidents due to electricity during the period under review, as compared with 1921, but it is stated that many of them could have been avoided if certain simple precautionary measures had been taken. it is apparent that many factory consumers who previously had their own generating plant, but are now taking bulk supplies at high pressure, do not realise their added responsibilities under the regulations, and attention is drawn to the unsatisfactory position that may result when the "occupier's man in charge" has previously had experience only of low-pressure plant. While there are, of course, plenty of factory installations beyond reproach, some are described as being in a "deplorable condition," while in other cases first-class plant has been erected in an "atrocious" manner. Such instances are obviously due to ignorance, or indifferent supervision, being the work of firms without proper qualifications.

With regard to public electricity supply stations, however, a great improvement is noted generally in electrical apparatus, at any rate in the Midlands. Nevertheless, "glaring" mistakes are still to be found in recent installations, due to the designers of h.p. switchboards not having actual experience in their operation under conditions of service. A large number of substations are also reported to be unsatisfactorily designed, inasmuch as transformers are not infrequently being placed below the switchboard galleries and alongside main cables where the maximum amount of damage is likely to occur in the event of the oil catching fire.

Another question raised by Mr. Ram is whether any other form of treatment for persons rendered insensible by electric shock is available either in supplementing or in substitution for artificial respiration. Electric shock may cause death in two ways: (*a*) by paralysis of the respiratory centre, in which case artificial respiration is the accepted proper treatment, or (*b*) by arresting the proper action of the heart and putting it into a state of "fibrillation," in which case no successful treatment has as yet been discovered.

It is with great interest, therefore, that we learn of Mr. Ram's suggestion that some form of mechanical shock following the electrical shock might prove to be beneficial even in those cases where cardiac fibrillation has occurred.

The United States and German Co-operation.

A statement has been issued in Germany announcing the re-establishment of the close business relations which formerly existed between the Berlin A.E.G. and the General Electric Company, of New York, and which were broken off through the war. The arrangements comprise the interchange of inventions and experience, and also permit the A.E.G. to utilise the laboratory work of the General Electric Company, this work being impossible to such a large extent in Germany under the operation of existing conditions. It is stated that the new agreement also provides for co-operation between the two companies in several countries.

The Factory Accountant.

It is generally admitted that costing came into its own during the war. To its antiquity many firms and many historical records can testify. The truth is, nevertheless, that under an unprecedented necessity for an immense variety of manufactured products, the level of manufacturing science was raised. Requirements, by way of accounts, of a Government buying at the rate of several millions a week, raised the level of costing, both in importance and efficiency. The factory accountant had greatness thrust upon him; his training, status, and outlook became a leading question among manufacturers.

The junior cost clerk of to-day certainly enjoys advantages which did not exist a very few years ago, and the difference is largely due to the activities of the Institute of Cost and Works Accountants. Now he knows he has a certain definite status to aim for—a status equal to that of the chartered or incorporated accountant. He knows, also, that by pursuing a course of study along which the Institute will guide him, the quality of his success will depend upon the quality of his own effort.

So much with regard to one side of the question. The other concerns his daily work, and this, in the sense that he is learning the right or the wrong way, makes his position much the same as that of any other apprentice. Wisely guided, he will endeavour to link the principles of which he is learning with the daily work he has to do, and, simple as such a course may appear, he will soon notice the clear dividing line between those who follow it and those who do not. His difficulty may be that constant routine work does not allow of this, but the important thing for him is to keep interested.

So far, we have little indication of what arrangements, as regards training, the Institute may be able to make with employers. Any such arrangements, while covering the whole subject of costing, ought also to instill very definite ideas on double-entry book-keeping (to final accounts) and a full appreciation of practical work in the factory.

Parts and processes form the basis of the costing system, and no cost accountant can allow himself to be ignorant of any with which his factory is concerned.

Here a suggestion might be offered. Form a habit of analysing the finished product, in components, and, as far as possible, in operations. As a mental exercise it rivals the best memory courses; as a game, it gives a pleasure no less than that we enjoyed in early years when we analysed, in a more practical way, some new mechanical toy. Learn to read drawings, yes! but, as a non-technical man, the factory accountant may find the assembling of a machine far more expressive than the most detailed drawing.

It may be asked: Why go to all this trouble about a machine with which one is already familiar? The reply is that, if frequently applied, the practice will enable one to rapidly analyse other products, be they lathes or cranes, electric motors, or shearing machines. The habit, like any other, becomes effortless, and its value is obvious.

In outlook the cost accountant must blend a keen, receptive, mathematical mind with a well-directed idealism. He may devise a perfect system, only to find that its theoretical perfection has brought about its failure. In spite of this, and remembering that he is dealing, first of all, with men and not with a faultless mechanical routine, he must still aim for the ideal—a system which will maintain a high degree of accuracy and usefulness with a minimum of labour and expense.

Status, though there still exists a certain amount of hard-dying prejudice, may be secured by the existence of such an organisation as the Institute of Cost and Works Accountants, by whose strict standard a guarantee is provided both for the cost accountant and for the manufacturer.

D

THE ELECTRIFICATION OF THE AUSTRIAN RAILWAYS.

The Innsbruck Section Approaching Completion.

The present year has witnessed notable progress towards the completion of the hydro-electric construction programme adopted in Austria. While the water power of the country is conservatively estimated at 5,000,000 h.p., only an insignificant proportion of this potential power has hitherto been utilised. The scarcity of coal since Austria lost to Czecho-Slovakia almost all the rich mines formerly comprised within the frontiers of the Austro-Hungarian Empire, has rendered imperative the speedy adoption of a substitute motive power for both transport and industrial purposes. Main consideration is being given to the requirements of the railways, upon which the whole economic prosperity of the country depends. The whole of the works have been designed by and are under the supervision of Dr. Paul Dittes, Chief Sectional Director of Austrian Railway Electrical Construction.

The resolution to free the federal systems from State management and to give them the status of legally-recognised corporations controlled by their own power of administration, has in no way affected the determination to convert the lines as rapidly as possible from steam to electrical propulsion. For this purpose additional water-power sites have been selected in the Vorarlberg, the Tyrol, and Salzburg, with a view to electrifying the greater part of the lines passing through this mountainous region of the country.

A commencement has been made in connection with the Innsbruck-Bregenz to Reichgrenze line, including the subsidiary Feldkirch-Buchs and Bregenz-St. Margrethen; Salzburg, Schwarzach-St. Veit-Spittal-Millstättersee-Villach; and the Schwarzach-St. Veit-Worgl lines, including the Salzkammergut lines, Steinach-Irdning-Attnang-Puchheim. The main operations include work in the Arlberg division, the Vorarlberg (Bludenz-Bregenz) and connecting lines, while work has been well advanced upon the electrification of the station and yard at Innsbruck.

Orders for the mechanical equipment required—twenty-seven electric locomotives for passenger service and twenty for freight trains—have now been placed.

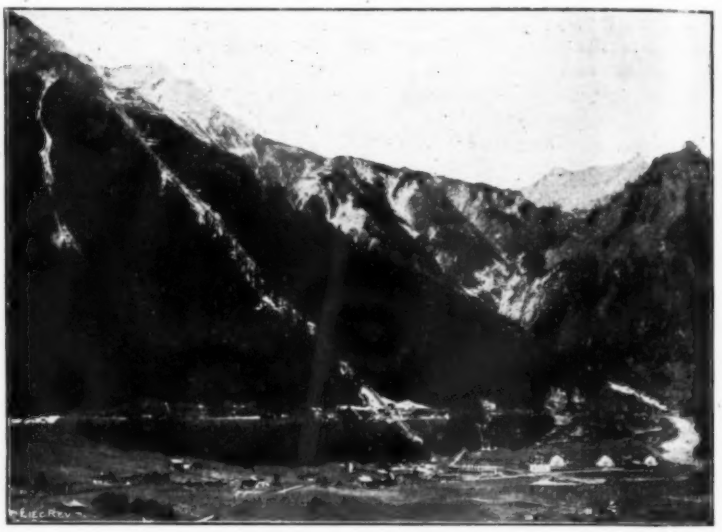

Fig. 1.—Pipe Line and Surrounding Country.

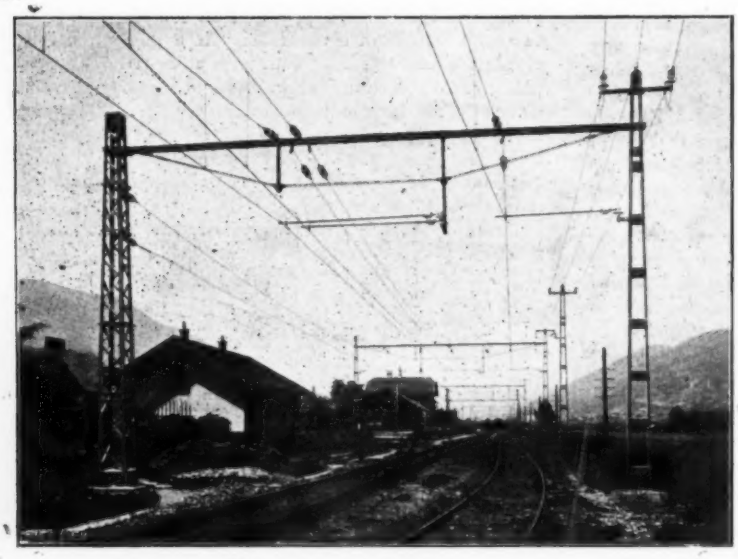

Fig. 2.—Overhead Construction.

Up to 1914, the two most important electrical stations in operation were the Ruetz works, located in the Stubai Valley, near Innsbruck, consisting of a high-pressure station without reservoirs, and developing an average power of 6,900 h.p.; and the Spullersee works, near Danöfen, in Vorarlberg, in connection with the line from Innsbruck to Lindau. The Spullersee works, a high-pressure station with a large reservoir, are intended to supplement the power provided by the Ruetz station in times of drought. The Spullersee station was constructed originally to operate the railway gradient between the Spullersee Lake, 1,795 metres above sea level, and the Kloster Valley, at Aflenz, 800 metres below. The area supplying the lake with water is no larger than 11 sq. km. The annual rainfall, however, amounts to 2.05 metres, and the annual outflow averages 18 million cubic metres. With an area of 18.4 hectares, the lake has a maximum depth of 19 metres containing a volume of water estimated at about 2,000,000 cubic metres.

The new construction work comprised the building of two stone dams, one 20 and the other 30 metres high, on the north and south sides of the lake to raise the surface by 28 metres and increase the volume of water by 13.5 million cubic metres. On the rocky southern bank a dam 30 metres in height has already been built; while on the opposite side the corresponding 20-metre dam is fast approaching completion. In order to exploit additionally the natural basin of the lake, the main gate has been built 10 metres below the normal

surface, which has been temporarily lowered by 12 metres by means of a discharging drift 90 metres in length, so constructed as to secure a more facile execution of the preliminary work. The upper-water drift, 1,900 metres in length, is now being constructed as a pressure channel, calculated to conduct six cubic metres of water per second. The channel conducting the power current pierces the chalk-stone of the upper trias and

Fig. 3.—Transmission Line Tower.

jura strata in a southward direction, terminating in a lock which contains an upper and a lower chamber and a narrow shaft for the rising water between them. From the lock three series of pipes with a bore of 960/650 mm. will conduct the water to the power house. When completed, the latter will contain six sets of machines of 8,000 h.p. each, representing a total of 48,000 h.p.

A large accessory plant will be required for the carrying-out of further constructions in this mountain region, which is rendered very difficult of access. One of the requisite accessories is a wire cable suspension from the Danöfen railway station (1,080 metres above sea level) to the Spullersee (1,820 metres), with a total length of 2,500 metres, traversing the precipitous Spreubach gorge by an unsupported cable 860 metres long. Besides this, there will be an inclined elevator, in the form of a triple-rail cable railway with a loop line, from the railway station to the level of the lock, for the purpose of surmounting a difference in level of about 750 metres.

On the steep slope of the Dürerberg mountain a tube conduit is being laid from the level of the lock down to the valley. Close to the mouth of the channel conducting from the lake, a shaft-shaped lock is being formed. From this the water will flow into the tubes after passing through the necessary blocking system. The tubes are being laid straight down the slope, crossing underneath the rails of the Arlberg railway-line to the Danöfen station, and thence to the power house.

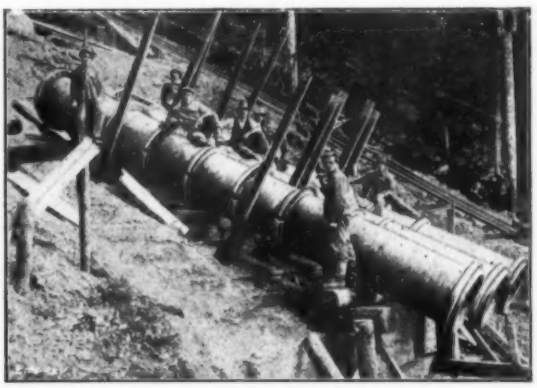

Fig. 4.—Pipe Line Under Construction.

Immediately opposite the series of pipes runs the inclined elevator destined for the transport of workmen and material, and utilised for the laying of the pipes. A guard is being erected against damage by possible avalanches.

Fig. 1 is a view of the county wherein the hydro-electric station is located. To the left on the summit is the reservoir from which two pipes (a third is to be added later) will conduct the water to the power house in the valley below. The length of the pipes is 1,300 m., the difference in elevation between the reservoir and the power house being 800 m.

The overhead conductor system at a station between Innsbruck and Landec is shown in fig. 2, while fig. 3 shows a 12-m. steel tower on a concrete base carrying the 35,000-V overhead transmission line above the City of Innsbruck, the length of the line being 125 kilometres.

Fig. 4 shows the steel pipe line under construction in September, 1922; each section of pipe is 8 m. long, the makers being Messrs. Thyssen & Co., of Mulheim. The water pressure at the lowest point of the pipes is 80 atmospheres.

THE JOINTING OF HIGH-PRESSURE CABLES.

The New Pirelli Method.

The question of the method to be adopted in the jointing of all high-pressure cables is one of great importance to all mains engineers. In the past, although various methods of insulating joints, &c., have been tried, progress, generally speaking, has been on the lines of a joint made with conductors united by either a sweating socket or a telescopic connection, and insulated with prepared tapes, the whole being enclosed in a lead sleeve filled with suitable oil or compound. These simple methods, although they have worked satisfactorily on cables up to 6,000 and 11,000 volts, are liable to show defects when higher voltages are used. For 20,000 volts and the like, such joints are not satisfactory, and a type has been evolved in which the actual conductor joint is enclosed in a paper tube having an internal diameter sufficiently large to allow it to be slipped loosely over the cores of the cable before the joint is made. After the joint is made, the tube is slipped over and forms a protection for the joint itself.

At the same time, it has been the usual practice to keep the three tubes used on a three-core joint separated by means of porcelain barriers, and these barriers have in turn been held in position by small wood barriers. Such joints, made up of materials of widely differing dielectric capacities, have proved sufficiently good for normal working, but the joint does not give such a high factor of safety as the cable to be connected. In other words, the joint would break down at a voltage which the

cable would easily withstand. This is undoubtedly a great disadvantage, as a joint when properly made should be the strongest link in the system, and in the type under discussion there is no margin to allow for bad or careless jointing.

In extra-high-pressure joints of this particular type, skilful handling is absolutely necessary, as it is of importance that the bare metal of the small-diameter joint shall nôt come in contact at any point with the inner surface of the large tube surrounding it. Should this take place, the inner surface would at one point be at the same potential as the socket, whilst the other parts of the tube would be at a considerably lower potential, thus setting up surface stresses which might eventually cause the joint to break down.

It is obvious, of course, that the easiest way to overcome the difficulty referred to would be to make the internal diameter of the tube a tight fit over the cores of the cable so that when the tube was in position, the insulation from the conductor of the cable to the outside of the tube would be as homogeneous as the insulation of the cable itself. This is undoubtedly a condition which is not easy of attainment in practice, because if the tube were tight fitting over the cores it would be impossible to get it into its final position without risk of damaging the layers of paper on the cores.

In order to obtain this homogeneous insulation from the cable to the outside of the tube, a type of joint has been evolved which does away with the necessity of having loose tubes, although the insulation of the joint is of the same material as the insulation of the cable itself, and at the same time is tight-fitting on the cores, so as to preclude the possibility of air spaces existing when the joint is finished.

In seeking to attain this result, advantage has been taken of a principle with which everybody is familiar, *viz.*, that if a sheet of paper is taken, loosely rolled up, and the inside edge of the roll held by one corner, the outside edge can be turned round in the direction to which it points, and the roll will immediately commence to tighten up until it eventually becomes a very stiff tube.

In the joint under discussion the impregnated paper, having been put into position over the cores, is held tight by the inner end, and by the simple method of turning the outer of the loose roll of paper, it immediately begins to tighten, until it becomes eventually a solid paper tube which will not unroll even if the pressure which is used to tighten it up is removed. The method of getting the roll of paper round the cores is interesting, as the paper is not put into position until after the joints are made and soldered. The most obvious way of doing this is to take the sheet of paper and roll it round the cores, but this would be very troublesome and would furthermore have the disadvantage that the paper would be handled by the jointer throughout its entire length, and as his hands might be dirty or moist, the joint would suffer thereby.

The method adopted to apply the paper to the conductor can be easily understood by simple explanation. If a nail be driven into a board so that a length of, say, ½ in. is outstanding and a spiral of wire is taken, the spiral can be placed against the nail and when rotated gradually will wind itself round the nail until the nail itself is in the centre of the spiral. Working on the same principle, the paper is rolled round the jointed cores, and eventually the core takes up a position inside the roll of paper itself, which is then ready for the tightening process above referred to. It is obvious that during this process the jointers' hands only touch the outside of the tube, and the remainder of the paper remains perfectly clean.

Another point of interest on this type of joint is that in order to get the best possible results, care should be taken to have the surface of the jointed conductors as smooth as possible, and to this end sweating sockets are

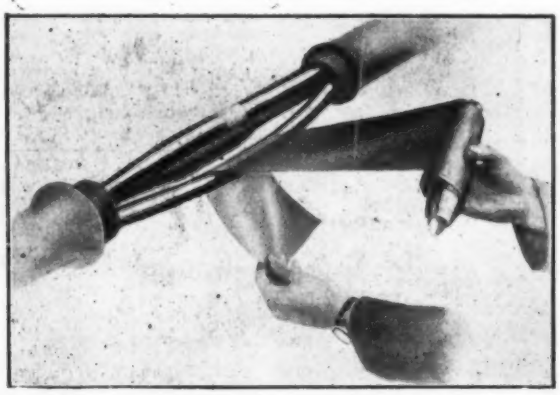

Fig. 1.

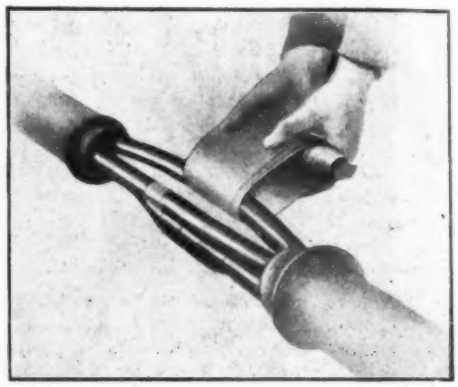

Fig. 2.

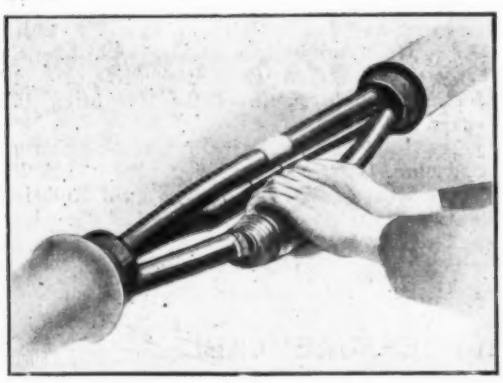

Fig. 3.

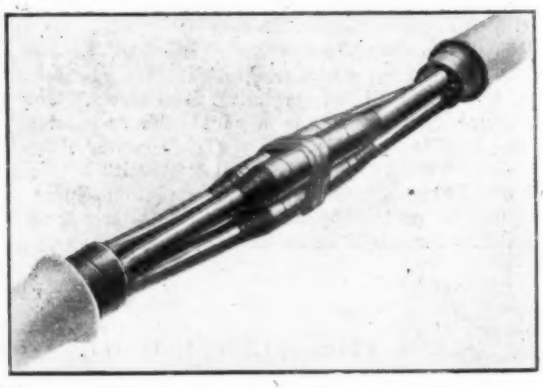

Fig. 4.

used for jointing the conductors, the overall diameter of the sockets being exactly equal to the diameter over the insulation of the individual cores. Furthermore, these sockets are prepared with rounded ends, and the paper insulation of the cores is undercut by means of a shaped cutter to the same radius, consequently, when the socket is placed in position on the cores, it fits into the paper at each end, and there is no space whatever in which air can remain. After the jointer has sweated the sockets, he carefully wipes off any metal which may adhere, and as the cores have been previously straightened over a sufficient length, the result is a practically smooth cylindrical surface on which the paper is wound in the manner above described. After the three cores on a three-core cable have been treated in this manner, they are squeezed close together and a further narrow layer of paper is applied in exactly a similar manner to the outside to form a belt, thus holding the three cores in position.

The exact method of carrying out the above operations can best be seen from the illustrations.

Figure 1.—This illustration shows a three-core cable joint—one core of which has been united by the sweating socket described above—the second core has been insulated, and the operation of applying the paper to the third core is shown. This illustration should be studied at the same time as figure 2, as by doing so the reader will obtain a very clear insight into the way the paper is applied.

It will be noticed in figure 1 that a short length of paper is uncoiled from the roll (which has previously been heated), slipped through the space between the cores and brought back to the roll again in the form of a loop. If the roll is then turned in the proper direction as indicated in figure 2, the roll itself will unwind, and the loop instead of being formed with a single thickness of paper will gradually increase until the whole of the roll is unwound and takes up its position round the core. It will be noticed that on the inner end of the paper a small tag is left, and when all the paper is wound on to the core, this tag is secured to the core by means of a piece of string. The object of this is to hold the inner end of the paper firmly whilst the final operation of tightening up the roll is carried out as shown in figure 3. As the coil is wound and the inner end is not free to move, it will be readily seen that the roll of paper becomes tighter and tighter as the operation is continued, and all the air between the various layers is excluded together with the superfluous oil. After the tightening has proceeded as far as is possible with bare hands, a strip of clean glass paper is taken so as to give the jointer a better grip on the roll, and the tightening operation is resumed until it is impossible to go any further. When this stage is reached, all the interior air will have been squeezed out, together with all superfluous oil, and there will be left round the jointed conductor a solid tube of paper which will not unroll even when the pressure is removed. The outer layer of paper will by this time have become dirty, but this layer is removed by the jointer, leaving a clean surface which has not been handled or in contact with dirt in any way. At the same time, the lugs on the inner end of the paper are removed. Figure 4 shows how a final binding of narrow paper is put round to hold all the cores in position.

The actual manufacture of the joint is simple, and in practice it has been found that there is no difficulty whatsoever in applying the paper tube, provided the core is well served with hot oil previously, and the tube itself, which is supplied in a sealed container, is thoroughly heated before application to the core.

Sector Cables.—A question might be raised as to the suitability of the type of joint described above for use on cables with shaped or sector conductors. Experiments show that there is no difficulty in making such a joint, and the ordinary tubular sweating sockets are used, as on round conductors.

In order to make a smooth surface for the paper tube to rest on, the insulation on the core is trimmed down a little near the socket by means of a sharp knife, although no attempt is made to make the insulation perfectly cylindrical.

It is found that if the core is well basted with hot oil before the application of the paper, the paper itself will take up the shape of the core.

It is to be observed that in this country cables with shaped conductors are only used on voltages up to 11,000 V, and these remarks refer to joints made on such cables. The special features about this joint which make it superior to those which have hitherto been used are:—

1. No other material is used in the joint except what is adopted for the insulation of the cable.
2. The joint is simple to make, can be completed in a minimum of time, and is very cheap.
3. It can be used for any pressure.
4. With the joint good results are certain, as it is stronger than the cable on which it is made.
5. The insulating paper used in the manufacture of the joint is not touched by hand during the operations, except the outer layer, which is finally removed.
6. The joint contains no foreign materials such as porcelain or composition spreaders, distance pieces, or barriers.
7. After the joint is made, the sleeve is easily filled without air pockets being formed.
8. The amount of insulation in the joint is predetermined, and does not depend on the individual ideas of the jointer making it.

As evidence of the excellent results obtained on joints of this description, the following figures may prove of interest:—

Test No. 1.—Cable joint 3-core, 0.15 sq. in., 33,000 volts. The joint was made with a strip of paper in such a way that the final tube was 12 in. long at the extreme ends and 7 in. long at the point of maximum diameter, the final thickness of paper on the joint being .48 in. After the joint was made, a test pressure of 75,000 volts, 3-phase, was applied for three hours, followed by 100,000 volts for five hours. At the end of this time the cable itself broke down at the end where the cores had been opened out for testing, but the joint itself was perfect.

Test No. 2.—This joint was made on a 3-core, 0.12 sq. in. 6,600-volt cable, the tube being 8 in. to 6 in. long and the radial thickness of paper 0.2 in. After jointing, a test pressure of 35,000 volts was applied for six hours, and at the end of this period of time the pressure was raised until at 58,000 volts the cable end broke down in the same position as Test No. 1, although the joint itself was undamaged.

Test No. 3.—This test was carried out on a three-core, 0.15 sq. in., 6,600-volt cable, the tube itself being 6 in. to 4 in. long. A test pressure of 35,000 volts was applied for six hours, which the joint withstood satisfactorily, but on the pressure being raised afterwards, the final breakdown occurred on the cable ends at 60,000 volts as previously; the joint itself was undamaged.

Test No. 4.—This test was carried out on a piece of cable made under the Bowden-Thompson patent, the size of the conductor being 3 x 0.15 sq. in., and the working pressure 11,000 volts. The paper tubes were 10 in. to 6 in., with a radial thickness of 0.48 in. insulation on the completed tube. The test pressure was 50,000 volts, which was applied for six hours between the cores and the earthed copper sheath, which was taken through the centre of the joint, and the whole joint itself tested quite satisfactorily. After this period of time the pressure was increased until the cable ends broke down at 96,000 volts, the joint itself being quite satisfactory.

The above results are remarkable, and show that with a correct application of scientific principles to the manufacture of extra-high-pressure joints, first-class results can be, and have been, obtained, and jointing need no longer cause mains engineers any anxiety.

In conclusion, it may be stated that letters patent have been applied for to cover the above method of jointing by the Pirelli-General Cable Works, Ltd., of Southampton, and Messrs. Pirelli & Co., of Milan.

AN EDISWAN WORKS VISIT.

The Manufacture of Radio Receivers and Valves.

While the majority of the products of the Edison Swan Electric Co., Ltd., are too well known to need any introduction, comparatively little has as yet been heard by what may be termed the outside public of Ediswan radio apparatus. It was therefore with special pleasure that we availed ourselves of a recent opportunity of visiting the Ponders End Works, where the policy of making every item, from the glass valve bulbs to the telephones and batteries, has been adopted. It is a policy that is open to very few manufacturers, for the valve is a stumbling block to most firms, but in this case the methods of manufacture revealed little with which to find fault. While the design of component parts has been organised on a production basis, much experimental work on complete receiving sets and "loud-speaking" devices is being done, with excellent results.

The tour of the works commenced with a visit to the glass houses, where the manufacture of bulbs of all types for both thermionic valves and electric lamps was in progress. These are claimed to be the oldest lamp works in Great Britain, and a more fascinating process it would be difficult to find. There are five furnaces in operation, and the work is carried out continuously during the 24 hours. The manufacture of glass tubing is a very interesting process, the skill and accuracy of the operatives in this work being remarkable.

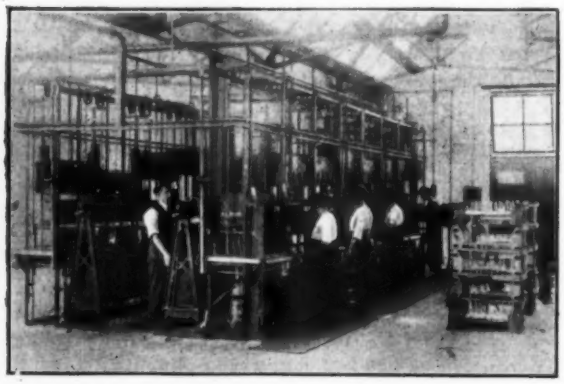

Fig. 1.—Some of the Valve Exhausting Benches.

The next department inspected was the new valve shop—a spacious building that has been specially erected to deal with the manufacture of valves of all types. The floor space is approximately 14,000 sq. ft., and many special machines are employed for the various processes. A neat little machine is that for fixing the grids on to their supports, and particular interest was taken in the electric welding machines used for attaching plates to their supporting stems. It may not be generally known that there are some sixteen different chemical elements used in the manufacture of a valve, and about 23 separate operations are involved in the process, behind which there is 40 years' experience in the manufacture of electric lamps; in fact, these are the works wherein Prof. J. A. Fleming made his first investigations into valve phenomena. Fig. 1 is a view of a corner of the new shop, showing the exhausting benches.

In addition to the familiar "R" and "A R" types, a product of considerable interest is the new "A.R.D.E." type "dull emitter" valve, which has given excellent results both on test and in practice. Its filament is said to be considerably stronger than that of an ordinary type of valve, and it is claimed to have a longer life in consequence of the low temperature at which it functions (somewhere about 400 deg. below that of an "A.R." valve). Its filament voltage is from 1.8 to 2 V, while the filament current is 0.3 A and anode voltage from 20 to 50 V; the bulb diameter is 29 mm. and its overall length, including pins, is approximately 110 mm., and it is provided with a standard 4-pin cap. This type of valve performs excellently and, contrary to expectations, its emission appears to be sufficient to give good results even when used as a last unit before a "loud-speaker."

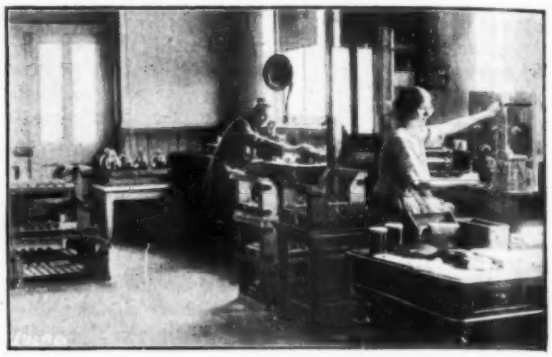

Fig. 2.—A Corner of the Valve Testing Department.

We noted that each valve is tested at the works for filament current, to check the filament resistance; for total emission possible, to ensure its correct output; and for reverse grid current, as a test of vacuum. A certain number from each batch are also tested on actual reception work. Fig. 2 is a corner view of the test room, and it might be mentioned that, in addition to the previously mentioned new valve shop and the testing department, about 4,000 sq. ft. of space in another part of the factory is also devoted to valve work.

The engineering side of the works was next visited, the first department seen being that in which dry cells of many types are made; this shop has, of course, been in existence for some time, the practice of pressing the depolariser at from 400 to 500 lb. per sq. in. into a block round the carbon and the use of a fairly stiff paste as the electrolyte, being followed, though it is only comparatively recently that the making of h.p. dry batteries has been undertaken; in the latter process much care is exercised to ensure good insulation. In the accumulator shops the various processes from the casting of the

Fig. 3.—Accumulator Assembly Shop.

grids, trimming and pasting them, and forming, to the final assembling, a portion of which department is shown in fig. 3, were watched; this section of the works has recently been extended, and the batteries produced are well finished even to small details.

From the cabinet making shop the party was conducted through the large shops devoted to the production of accessories; the manufacture of component parts of all types, such as high- and low-frequency transformers, variable condensers, Dewar keys, "headphones," &c., being carried out in its entirety. The telephone headpieces are made throughout in the works, and are very comfortable to wear.

The assembly of complete receiving sets afforded considerable interest; various patterns are being made, from simple crystal to 4-valve sets, including one which is not yet on the market, but which is being looked forward to eagerly; these sets are all of vertical cabinet form and of most excellent design and quality.

In general, the Ediswan Works at Ponders End cover an area of approximately 36 acres, and afford employment for several thousand hands, both male and female. The minute care that is taken at all stages of manufacture is a noteworthy feature, and if careful design and good workmanship count for anything, the products will leave little room for fault finding.

NOTES FROM CANADA.

[From Our Special Correspondent.]

A daily paper recently announced that work was to be started early in July, by the Canadian National Railways, on the construction of a new electric railway line to run eastward from Toronto to Bowmanville, a distance of about 35 miles. About $3,000,000 will be spent on this work.

The Canadian National Railways also propose to spend about $2,300,000 on improvements to the Niagara, St. Catharines and Toronto Electric Railway.

A well-known British electrical firm not long ago had a disappointing experience, for, in tendering for municipal work, it submitted the lowest figure, but as the difference between its price and that of a large Canadian firm whose headquarters are in the municipality referred to was very small, the contract was awarded to the latter firm. The incident indicates, however, that enterprising British firms can make quotations which are competitive, for the price quoted by the next highest tenderer was some 20 per cent. higher than those of the two firms already referred to.

The Ontario Government a few weeks ago authorised the construction and operation by the Hydro-Electric Power Commission of Ontario of an electric line connecting Toronto with Oakville, about 20 miles away. Part of this line is already constructed, and has been in operation under private ownership for a good while, but when the Commission finally took over the properties of the Toronto Power Co. some months ago, the line came under the Commission's control.

Public ownership of electrical undertakings in Ontario, although it has been fiercely assailed from many quarters during the whole period of the existence of the Hydro-Electric Power Commission, is very much in favour with the people, judging from the recent Ontario elections (held in June), when Sir Adam Beck, who lost his seat 3½ years ago in London, Ontario, regained it this time by a large majority, and the Conservative party, which has in the past been more friendly to "hydro" than any other party, was returned to power with a large majority over all the other parties added together. It is not known definitely to just what extent the votes of the people were for "hydro," as there were other issues involved as well, but the general impression is that many people voted specially because they considered that under the late (Farmer) Government the whole "hydro" undertaking was in danger.

The difference of sentiment on the subject of public *versus* private ownership of electrical undertakings in the sister provinces of Ontario and Quebec is striking, the former being as shown above, strongly in favour of public ownership, while in the latter private ownership has a very firm hold, and there never seems to be any suggestion of making a change.

The manner in which the Quebec Government deals with the matter of water-power development is unusual and possibly unique, but it seems to work well and to suit the people. The Quebec Streams Commission, appointed by the provisional Government, makes surveys of water powers and, where conditions warrant it, designs dams and other regulating works (which are let out to contract) with a view to utilising and conserving the water powers to the fullest practicable extent. The water thus made available for power purposes may be had by private companies, which, of course, pay for the privilege. The companies then construct their own generating stations, &c., according to their own requirements.

It is reported that the Southern Canada Power Co., Ltd., intends next year to begin development work on the second of the series of six water power sites on the St. Francis River, which will mean an addition of about 30,000 horse-power.

Four water turbines and generators of 10,000 h.p. each are being added to the existing 14 sets of the same size at the Cedars Rapids plant on the St. Lawrence River, which plant is owned by the Montreal Light, Heat and Power Consolidated.

London, Ontario, with a population of only 60,000, has a connected load of more than 50,000 h.p., which, it is claimed, is the largest *per capita* in the province. There are 3,500 electric ranges installed in this one city.

The province of New Brunswick suffered severely during May, as all the hydro-electric developments in the south and western parts were damaged more or less seriously by floods, which in some parts attained serious proportions.

In Saskatchewan, about 500 miles of new telephone lines are to be added to the Government system.

The *Electrical News* (Canada) some little time ago described a very interesting development in the application of electric power, *viz.*, its use in the logging industry. Electricity has been used very successfully for the hauling of logs in the forests and for the making of the enormous log rafts which are floated down the rivers, as well as for other purposes. It is said that the greatest advantage of electricity for this work, instead of using a boiler and donkey engine as is usual, is the elimination of the fire risk, although in addition it seems to be proving cheaper and more effective than the old methods in many other ways. That the fire risk is a serious matter may be gauged from the fact that Canada *every year* loses many millions of dollars' worth of valuable timber through forest fires; this year has been very bad in this respect, and many miles of transmission lines have been destroyed. It is reported that the mining camps of Northern Ontario are likely to see two or three thousand electric horse-power developed by Diesel engines.

A daily paper says that several Diesel engine makers claim that they can undersell the present electric power supply at about $50 per h.p.-year, one firm claiming a cost for Diesel engines of $39. Steam power is said to cost from $150 to $200 per h.p.-year.

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

Unemployment.—Sir M. Barlow, the Minister of Labour, in a statement on unemployment made in the House of Commons on August 1st, referred to the working of the Trade Facilities Act, and said that the best known undertakings commenced under the scheme were the extension of the Tube railway from Golders Green to Edgware, the enlarging of the City & South London Tube, and other improvements on the underground railways. For these, a guarantee up to £6,500,000 was given. Under the scheme of the Act guarantees were being made use of up to £26,000,000. This included the guarantee of £5,500,000 for the electrification scheme of the South-Eastern Section of the Southern Railway. Post Office work would be pressed on, particularly trunk telephone cable laying. The Electricity Commissioners, also, would be doing a service to the community if they could stimulate the progress of electrical development throughout the country. The railway companies, again, were now in possession of very large reserve funds running into some £130,000,000. Now that amalgamation schemes were complete the railway companies could render very ready help to the community in this time of trouble by utilising their large resources for necessary reconditioning, and also for the electrification which was becoming more and more necessary in many cases owing to the development of suburban traffic, and which must be undertaken at an early date. The Government had decided to adopt a new plant with regard to loans for revenue and non-revenue-producing schemes, on a financial basis of a grant equal to 50 per cent. of the interest on the loans raised for a period of not less than ten years. The grants would continue for the period of the loan, or for 15 years, whichever was the shorter. The terms offered should be a real help to local authorities in launching work such as tramways, electricity supply, and so on, all over the country. The Government also hoped that corporations and private companies operating public facilities would be equally stimulated to provide work. The total provision to be made by the Government under this head would be £10,000,000.

In the debate which followed, Mr. H. M. Butler said that if the electrification of the main railway system of the country was seriously tackled it would give an immense impetus to the engineering trades. The most prosperous period in the engineering industry which he ever knew was when £100,000,000 was spent on the electrification of the tramway system of the country in three or four years.

Dr. Macnamara, the former Minister of Labour, asked if Sir M. Barlow was satisfied that the policy of railway electrifica-

tion was being carried out to the extent it ought to be. There were, "in the air," great schemes of electrical power development, for which capital should be available.

Mr. Sidney Webb said it was not enough to talk about schemes for electrifying suburban railways on the Southern and other lines. Surely, there were larger schemes for the electrification of large stretches of the main line which had been under the consideration of the companies, which the companies knew would be profitable to them, and which might be put in hand if only the Government would exercise its influence on the companies.

Mr. N. Chamberlain, the Minister of Health, said that the Government desired, so far as possible, to encourage revenue-producing schemes. He took as an example of such a scheme the extension of a power station. That meant work for a large number of skilled men at different trades. As to whether the Government was satisfied with the dispatch with which the railway companies were proceeding with their electrification schemes, his answer was in the negative. The Government had made representations urging the companies to push forward their schemes at a greater rate. With regard to the electrification of the suburban and minor lines, he thought that the companies might undertake this in quicker time. There could be no doubt that the companies had ample resources with which to carry out these works.

Stoke-on-Trent Tramways.—On July 31st, on consideration of the Stoke-on-Trent Corporation Bill in the House of Commons, Lord Curzon moved to delete a sub-section giving to the local tramway companies the right of appeal to the Ministry of Transport against the decision of the Corporation on any application for a licence to run omnibuses on any tramway route. He contended that the acceptance of his amendment would put an end to the danger of a monopoly being given to a tramway company whose services were most inefficient.

Sir T. Robinson, the Chairman of the Local Legislation Committee which considered the Bill, asked the House to pass the measure as it stood. The Committee believed that the powers therein contained would provide for public convenience, and would secure greater safety for the inhabitants of Stoke-on-Trent. The tramways had over forty miles of single track which they maintained, thereby saving the ratepayers considerable sums in road repairs. The undertaking paid £12,000 a year in rates. He thought that the House might trust to the Ministry of Transport to see that justice was done as between tramways and the owners of motor-omnibuses.

The amendment was rejected by 120 votes to 113, and the Bill was read the third time.

Electric Lamps in Mines.—On July 31st, Mr. Paling asked the Secretary for Mines whether any statistics were yet available showing the number of cases of miners' nystagmus at pits where electric lamps were used, as compared with pits where oil lamps were used.

Lieut.-Col. Lane-Fox said there were not. Such statistics would be of little value in themselves owing to the number of factors involved.

Electricity Schemes.—On July 31st, Colonel Wilfrid Ashley, replying to Mr. D. C. Somerville, said that the Electricity Commissioners were not aware of electricity extensions which were being delayed owing to the inactivity of local authority undertakers. On the contrary, there had, for some time past, been much activity on the part of the authorities as was shown by the fact that the Commissioners during the past three years had sanctioned the borrowing of no less than £36,000,000 by these authorities for electricity purposes.

Special Orders.—On August 1st, on the motion of Col. Ashley, Special Orders made by the Electricity Commissioners under the Electricity (Supply) Acts, 1882 to 1922, and confirmed by the Minister of Transport, were approved in the House of Commons with regard to the following places:—Coalville, Ashby-de-la-Zouche, &c.; Budleigh Salterton; Matlock, &c.; Banstead, Walton-on-the-Hill and Kingswood; Chipstead; Wooburn (Wycombe), &c.; and Formby. Similar Orders were approved by the House of Lords.

Electrical Trades Union.—On August 1st, Mr. Muir asked the First Commissioner of Works if, in view of the charges which had been made by officials of the Electrical Trades Union against the contractor carrying out the electrical installation at the Science Museum, South Kensington, of evading the specification issued by his department by putting in faulty cables and generally carrying out the installation in an unsatisfactory manner, and seeing that an inquiry was held on the site, the result proving the correctness of the charges made, and that the faulty work had been passed by the divisional engineer of His Majesty's Office of Works, notwithstanding that his attention had been called to the faulty work by the clerk of the works on the job, he would make an inquiry into the whole matter and state if any additional cost had been imposed on his department.

Sir J. Baird said he did not admit the accuracy of the statements in the question. The whole matter was investigated on the spot by the chief engineer of his department, and all the charges proved to be unfounded except one, namely, that a damaged cable had been repaired by the contractor's foreman without the knowledge of the officers of his department. This had been put right at the contractor's expense. A small charge would have to be borne by his department for expenses incurred by the contractor in the course of the investigation of the other charges which proved to be unfounded. He saw no reason for any further inquiry into the matter.

Electric Accumulator Works.—On August 2nd, Lord H. Cavendish-Bentinck asked the Home Secretary if his attention had been drawn to the high incidence of lead poisoning in electric accumulator works; if he was aware that the *Labour Gazette* reported 14 cases in May and 22 in June; and whether, in view of the fact that strong regulations for the protection of workers in this occupation existed, he would consider the desirability of appointing additional inspectors to find out whether these regulations were being properly carried out and, if so, whether new regulations were required.

Mr. Bridgeman said he was aware of the figures referred to which were supplied to the *Labour Gazette* by the Factory Department. Most of the cases in question (10 in May and 19 in June) were reported from two works at which there had been a sudden increase of orders and work had been carried on under conditions which, though not involving any breach of the Regulations, were unsatisfactory. The matter had been taken up strongly with the firms, both of whom were re-organising the departments affected. The chief inspector was satisfied that the increase of lead poisoning cases in these works was not attributable in any way to any lack of inspection.

Royal Assent.—The Royal Assent has been given to the Public Works Loans Act, the Railways (Authorisation of Works) Act, the London County Council (Money) Act, the Greenock Corporation (Electricity) Act, the Potteries and North Staffordshire Tramways and Light Railways Act, the Swanage Gas and Electricity Act, the Shropshire, Worcestershire and Staffordshire Electric Power Act, the Wimbledon and Sutton Railway Act, the City and South London Railway Act, the Torquay Corporation Act, the London Electric Railway Act, and the Stoke-on-Trent Corporation Act.

Summer Adjournment.—Parliament rose on Thursday, August 2nd, until Tuesday, November 13th.

Electricity in Mining Work.—From all parts of Great Britain delegates were present at Nottingham, on Saturday, at the annual conference of the Colliery Officials' Federation, when attention was directed to many important considerations regarding the use of electricity in connection with mining work. The organisation represents a membership of 10,000, and Mr. J. P. Houfton, M.P., a past president of the Institute of Mining Engineers and one of the directors of the Bolsover Colliery Co., emphasised the consideration that in connection with improving the safety of life the increasing use of electrical arrangements was becoming of paramount importance. He believed that he was the first to institute electrical haulage in a mine. There was, in his view, no end to the possibilities of the use of electricity in mines, as difficulties were increasing as collieries were becoming deeper. It was now common in the area east of Doncaster to raise coal from a depth of 900 yards. As these pits became exhausted it would be necessary to go deeper still and to find how a mine, 1,500 yards below the surface, and with a natural temperature of over 100 degrees, could be kept cool enough to enable men to work therein. In that connection electricity as a motive power must necessarily play an essential part in solving difficulties inherent to deep mines as to many other colliery workings.

Railway Accidents.—The Ministry of Transport has published the annual report of its Chief Inspecting Officer upon the accidents which occurred on railways in Great Britain during 1922. (H.M. Stationery Office. Price 6d.) It is seen that the number of persons killed was reduced from 765 to 722, but the number injured increased from 18,973 to 19,462. There were 28 train accidents, classed under seven heads: Failure or insufficiency of (*a*) engine and rolling stock (6); (*b*) signalling and permanent way (5); failure of enginemen to obey or observe danger signals (6); failure of enginemen to give effect to regulations (3); failure of signalmen to observe or give effect to regulations (3); failure of other employés to give effect to regulations (4); faulty method of marshalling for high speed (1).

In seven of these cases (25 per cent.) a system of automatic train control would have prevented accident. The use of a continuous brake on freight trains would have prevented two of the accidents. Improvements in design, in material and in methods of examination and of fastening were noted as likely to have beneficial effect in five cases. A modern type of facing point equipment would have prevented one accident, and an alteration in the method of working movable diamond points would have prevented a second.

The general conclusions are: (i) In respect of maintenance of equipment there is still, in certain directions, some leeway to make up before the high pre-war standard is attained. (ii) The need for a system of automatic train control as a method of providing greater security against accident continues to be proved.

BUSINESS QUALIFICATIONS.

In connection with the formation of new limited liability companies or the reconstruction of existing concerns, it is important that close attention should be devoted to the need for securing the most suitable men as directors of such concerns so as to avoid errors of judgment and ignorant or reckless policy, to prevent failures, and to reduce the chances of loss for others connected with the industry. The bankruptcy and liquidation columns are sufficiently prominent in these days to attract more attention than has been the case for some time past. It is desirable that this state of things should be altered, though without placing too onerous a restraint on reasonable enterprise. We have heard American hustler-type big-store men speak deprecatingly of the British commercial system because it does not allow men to go the pace with so free a rein as is granted across the Atlantic, but on the whole the British temperament is not to be blamed because it prefers to proceed with fair caution viewing with disfavour the suggestion that three fires and a bankruptcy are a pardonable pathway to success.

There are many aspects of such a subject with which one might deal with profit just now, but our attention has been specially directed to one particular tendency which was more in evidence some years ago, but which is unquestionably present with us still. The point in mind is one of special interest to those who are disposed to prefer a great name to an efficient man, when they are on the look-out for directors for a new company or for new directors to fill vacancies on existing boards. One may well ask sometimes why certain men were ever elected to any board at all, let alone the board of an industrial company. But sometimes there is a very satisfactory answer, though it may not appear on the surface.

It may be that a man joins a board because he has a large financial holding, though he knows nothing about the business. Perhaps he is a representative of others who have such an interest. Maybe he is a representative in trust for the beneficiaries under a deceased estate. Maybe he is acting as a director with a view to ultimate predominating control by others for whom he is nominee. These are all legitimate enough as reasons for appointments to the board of a company. Yet in such cases there is the possibility that in his zeal for immediate profit the said director may be favourably impressed by what are really short-sighted economies. He may not be able technically to appreciate that a capital outlay of a few hundreds or thousands may mean a marked economy per annum in operating costs in many subsequent years; he may also in the course of a penny-wise policy advocate the employment of a second-rate man where a first-class and better-paid employé would more than justify his salary in a very short space of time. There are many other pitfalls lying in the path of the pound-foolish director. We cite these merely as examples.

We do not desire to belittle the director of financial qualifications. He has a very important place to fill in many business concerns, but he needs to have a receptive mind and a willingness to follow sound advice from sound men, his companions on the board, or responsible heads or employés, who, by special training and experience, know with intimacy the affairs of the business, its staff and workpeople, the clients and markets consuming the product. Financial qualifications are as essential as technical in most industrial undertakings. A technical man minus financial or business qualifications may make as serious mistakes as a financial man without technical capacity. The ideal director is the man who combines both qualities, but he will be too valuable a man to spread himself over too great detail, will not be content with small concerns, will inevitably be in demand—if he desires to be, and will allocate the duties to specialist assistants. The most successful man of all is one who can most efficiently secure and utilise the services of others.

But of what actual value on the board of any concern is a peer who is put there because he is a peer, or a "titled gentleman" who is put there purely because he is such? Possibly he may have family or high social connections which will be of assistance in finding additional capital should it be needed. Possibly the same connections may possess value as a means for introducing business from the circle in which he moves. These are matters which cannot be ignored at times, but, speaking generally, one would not think well of such an advertisement as appeared in a leading daily paper recently which called for a "Peer or Titled Gentleman as director of large industrial company; fees —— and expenses." In such a case we may be permitted to hope that the qualifications of title and position will be exercised in manners such as we have indicated, but he should not be allowed, on those qualifications alone, too much authority in other directions connected with the business. Everybody knows that men are getting their living in ways which are far from normal in character; strange ways are always turning up in which men of resource are making a fair income, and sometimes with very little effort—name, influence and station in life work for them. For ourselves, however, unless the titled director be one who has gained his title because of actual personal achievement which has marked him out as a man of capacity, we should think more of the board from which he was absent than of the concern which could boast of two or three directors of his class.

We do not overlook the fact that on many boards it is essential that there shall be men able to take a large and long view of affairs—they may be neither financiers nor technicians. Such will not be expected to concern themselves with the hundred and one details—commercial, accountancy, and technical, connected with production or contracting. These men undoubtedly have their place.

What we cannot abide for one moment is the election of directors of title or popularity who sell their names for fees and other considerations because it is desired to impress the simple public who have no advisers to warn them and who may be deluded into taking shares because an air of respectability is given to an undertaking by the presence of My Lord So and So or Sir Somebody Else on the board.

Radio-Telephony on Fishing Boats.—The chief of the Nagasaki Prefectural Marine Products Bureau, Japan, together with a committee of men interested in marine products, is reported to be investigating the possibilities of installing wireless telephone outfits on the larger-sized fishing boats which have their base at Nagasaki, to enable them to communicate with shore when in difficulties, and to report the catch in time for their owners to realise on it.

There are about 150 fishing boats on which equipment might be installed, and though they frequently go distances from shore too great for direct communication, it is believed that a system of relays could be developed by which messages could be sent through to land. Sets of Japanese manufacture will doubtless be favoured where suitable equipment can be obtained locally.—*Commerce Reports.*

Radio Amateurs Mobilising.—In future, radio amateurs in all parts of the country, however remote, will have a definite voice in the affairs of the whole amateur radio movement in Great Britain. This, in effect, is the object of a new step which is being taken by the Radio Society of Great Britain. Under the proposed arrangement, which is fully described in this week's *Wireless World and Radio Review*, the country will be divided into four sections, each of which will appoint its representative to sit on a central committee. The four groups comprise Scotland, Wales and the West, the East, and the South. In view of the approaching publication of the report of the Postmaster-General's Committee on broadcasting, the new scheme will, it is thought, contribute to the solidarity of the amateur experimental movement when it may be most needed.

MENTAL "SKIN EFFECT."

By "MIDGET."

Reasoning by analogy, or argument from resemblance, is often useful in enabling clear ideas to be formed in technical engineering problems; has not the analogy between the behaviour of electricity in a conducting circuit and that of an incompressible fluid in a pipe line been of benefit to most students of elementary electricity? The scope of useful analogies is not limited to purely technical matters: some stimulating trains of thought may be started by drawing analogies between phenomena in the material sphere and what, for want of a less high-sounding but equally descriptive phrase, may be called operations in the field of human conduct.

Consider, for example, the well-known "skin effect" met with in dealing with high-frequency currents of electricity. This is not intended to be a strictly technical article, but to enable the argument to be developed it is necessary to touch upon the leading features of "skin effect" and the remedies for it. In direct-current work and the ordinary low-frequency alternating-current work the current in a conductor is distributed uniformly over the cross section, but when currents of the frequencies used in wireless work, which range from 20,000 cycles per second upwards, are being dealt with, it is found that the current flow is restricted to a thin skin on the surface of the conductor, with a consequent increase of resistance. The skin effect increases, that is, the effective current carrying film is thinner, the higher the frequency and the greater the electrical conductivity and magnetic permeability of the conductor material. With circular conductors, the larger the diameter the thinner the useful skin, other things being equal.

There are two ways of minimising the trouble with a conductor of given material; the first is to use hollow tubes or strips of rectangular cross section, as thin as mechanical considerations will allow, thus obtaining a maximum of surface for a given weight of material; the second is to use specially-woven cable built up of small insulated wires in such a way that all the individual filaments move over the same average path, each one lying on the outer surface of the completed cable, and visiting all parts of the cross section the same number of times in a given length. If the qualities of such specially-formed cables are to be fully utilised, steps must be taken to ensure that the current to be carried is initially divided equally amongst the individual wires; this is done by fanning out the wires at the end in such a manner that all the strands are similarly situated electrically; for example, the strands may be arranged one deep round the edges of a relatively large rectangle. The insulation on the strands prevents their parting with current to their neighbours, and thus the centre of the completed cable carries current notwithstanding the "skin effect."

Now for the analogy. There is of necessity much engineering work of what may be called a "high-frequency" character, many posts in which one is called upon to perform day after day the same sort of work with apparently little scope for the exercise of initiative or ingenuity. It is to be feared that there are many disappointed men engaged upon such high-frequency tasks, men who feel that they are in a blind alley, with whom regularity has become monotony, and monotony has been succeeded by boredom. In other words, they are suffering from mental skin effect; the surface only of the mind is bent upon the day's work, and the rest of it is not being used. The mind, like the muscles, will atrophy if not exercised; unless it is kept in full and regular use, it may fail to function properly when a sudden call is made upon it—possibly with disastrous results. Remember the cures for electrical skin effect: the strip construction increases the working area of the conductor—increase the working area of your mind. There is abundant food for thought in connection with even the most routine tasks, innumerable ideas to be picked up and developed in every power plant. A little thought will reveal opportunities for mental exercise. Use all the senses carefully, keep the mind alert; ponder over what you observe, and keep the mind supple. The second method of dealing with skin effect—that of the interlaced fine strands—should suggest several salutary ideas. Each strand visits all parts of the cross section with equal regularity, and all the strands carry equal currents. Do you visit the dark spots and the awkward corners quite as regularly as you should? Do you resist the natural tendency to be easily diverted from an unpleasant task? Are you really thorough—do you stick to the teasing problem till you have really solved it, or does a very rough approximation, not to say a rather wild guess, have to suffice? Think it over and think it out.

To the man in a position of control the interlaced cable should suggest some further pointed questions. Have you ensured that all your staff are equally loaded? Is the distribution of the tough tasks fair? The wise user of the woven cable ascertains at frequent intervals that the insulation of the strands is sound, and that there are no tendencies to chafing. Wires that show bright when on the surface of the cable have lost their insulation and will probably give up their current if an opportunity occurs. It is well, then, from time to time to check that your human insulation is sound, and that the showy man is really a bright man—a very different thing. He may have pushed some of his load on to someone else when out of the limelight. Remove all possible causes for chafing among your staff if you would avoid loss.

The careful reasoner, when arguing from analogy, endeavours to discover how far the resemblance is complete; let us therefore examine this skin-effect analogy for possible departures from resemblance. Well, in the electrical case the greater the magnetic permeability of the conductor material the greater is the loss due to skin effect: in the human case the more permeable the mind is to new ideas the better; beware, however, of mental hysteresis—keep the mind supple.

The ultimate object of the high-frequency currents used in wireless is the communication of intelligence: properly utilised there is no "high-frequency" or seemingly only routine job that cannot be made the source of valuable knowledge and experience. The high-frequency current is a means to an end; the keen man in a routine job will make that post a stepping-stone to one in which the mental agility to which he has trained himself will be of pecuniary benefit and a source of mental satisfaction to him.

The Starting Torque and Current of Squirrel-cage Induction Motors.—Correction.—With reference to Mr. T. F. Wall's article in our issue of July 13th, in fig. 6 the squares of the values of the transformation ratios u have been marked on the respective curves instead of the true values of u. In fig. 6, therefore, instead of $u = 1 : 1.25 : 1.5 : 2$; read: $u = 1 : 1.12 : 1.22 : 1.41$ respectively.

This requires that the latter part of the penultimate paragraph of the article should be amended as follows: "... if the starting current in the line is about twice the normal full-load current, and if the ratio $R'_2/r'_2 = 3$, the starting torque will be about equal to the normal full-load torque."

Optical Engineering.—The Department of Optical Engineering and Applied Optics, of the Imperial College of Science and Technology, which was originally sanctioned for a period of five years, has now been placed on a permanent basis. The Department is continuing the good work which distinguished it during the war, and it is hoped that by its agency the optical manufacturers of this country will never again revert to the unfavourable position which they held, in comparison with foreign manufacturers, before the war.

MODERN ELECTRIC MOTOR CONSTRUCTION.

In our issue of April 27th (p. 650) we illustrated the "one-piece" rotor of an induction motor, made by an American company. In a recent contribution to the *American Machinist* Messrs. J. M. Burr and H. Campbell gave more extended details of this and other motor-construction processes.

In the older attempts at riveted construction, rivets shouldered at both ends were used and frames were carefully machined, laminations were stacked on the rivets and then when the rivets were headed the end frames were parallel and in alignment. Unfortunately no allowance was made for the variance in the thickness of the sheet metal employed, and after the rivets were headed it was generally found that the laminations were very tight on one side of the core and very loose on the other. This construction was changed from failure to success by simply omitting the shoulders from the rivets and allowing the end frames to tilt or cock so as to bring about an equal pressure on all parts of the laminations.

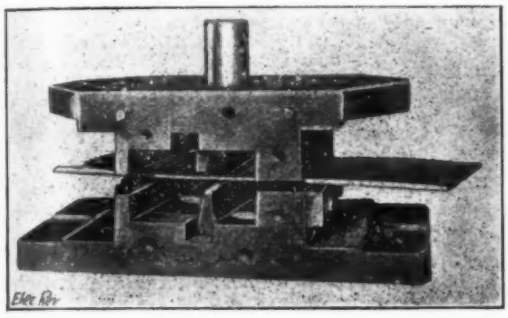

Fig. 1.—Forming Dies.

After riveting, the end frames were machined from the centre of the core, which not only made a concentric bore but as both were machined at the same setting, it assured that the end plates would have parallel seats and that the bearings would be aligned.

For many years it has been realised that sheet copper, from the standpoint of electrical uniformity, would be the ideal material for rotor windings. Its introduction, however, seemed to present appreciable difficulties until the Louis Allis Co., Milwaukee, Wis., undertook to utilise it for that purpose The elimination of a large number of joints, and the leaving of the copper in the best possible mechanical condition were the objectives. In attacking this problem, it was evident that the winding must be applied from the outside of the rotor. This at once led to the use of an open type of slot, and here again the older theory has been discredited because it has been found that by maintaining a certain ratio between the slot opening and the air gap, the characteristics of the motor need not suffer appreciably. The use of an open slot not only permitted the winding to be introduced from the periphery

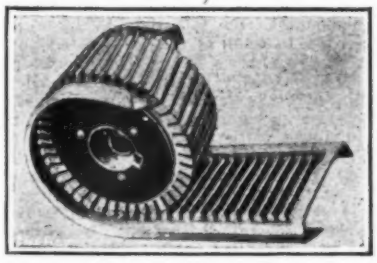

Fig. 2.—Appearance of Sheet Rotor Bars.

of the rotor, but incidentally simplified and cheapened the construction of the dies for blanking the rotor laminations, because it eliminated much of the hand work.

In line with modern practice, the rotor bars are of necessity left uninsulated. In order to facilitate wrapping the winding into the rotor core, the slots are not made radial but are off-set so as to facilitate the rolling-in operation. The sheet of copper used for the rotor windings is cut to the proper width and then seamed at the sides on a folding brake, the amount of seam depending upon the amount of end-ring copper required. It is then put through a piercing operation in which a series of small holes are punched the proper distance apart across the sheet and of the proper pitch to correspond with the finished rotor. These holes also constitute a clearance for the ends of the shear by which the bars are separated and given a slight twist. The holes have another function in that they prevent sharp corners which might be responsible for starting cracks in the copper. By means of the forming dies shown in fig. 1 the slotted bars are twisted to approximately the right angle of the slots. The pitch of the bars does not correspond with the final position which they will occupy in the finished rotor, but is more nearly approximate to the chordal distance of the slots at the periphery of the rotor. The copper is now ready to be fitted into the slots in the rotor, which is done by means of the rolls shown in fig. 3. The first copper bar is inserted in a slot and the machine is then started, the operation of which presses each copper bar into its corresponding slot, as shown in fig. 2. After the copper bars have been rolled into place, the roll on the near side of the machine is exchanged for a

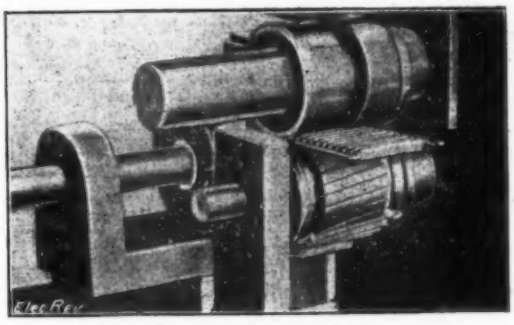

Fig. 3.—Rolling Sheet into Slots.

roll that contains rows of spiral teeth corresponding with the slots in the rotor. As the rotor is revolved, these teeth force the bars into the slots and expand them so that they will fit tightly. The next operation is to bold the end rings together so that they can be soldered. Silver solder is used for this operation; the finished job is shown in fig. 4.

The rotor is now placed in a contracting chuck and pressure is applied endwise, using an oil-gear press. A plug

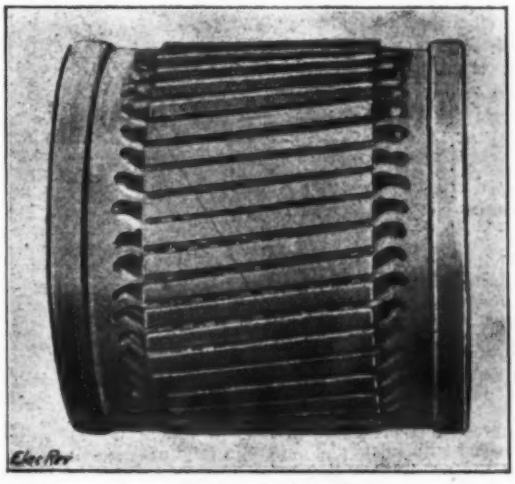

Fig. 4.—The Finished Rotor.

is placed in the bore of the rotor and a collar is slipped over it which insures that the end rings will be concentric with the shaft. This operation compresses the metal in the end rings, making them about ten per cent. smaller and carrying the bars into the bottoms of their respective slots. Compressing the copper in the end rings also hardens it.

The foregoing is an illustration of a somewhat radical departure from the conventional rotor construction that is indicative of the general tendency toward a reconciliation of manufacturing methods with theoretical consideration.

THE HOWDEN-LJUNGSTRÖM AIR PREHEATER.

An Interesting New Device.

It is generally agreed that no further very material improvement is to be hoped for in the performance of prime movers in electricity generating stations, but that the fundamental problem of the economical generation of steam deserves to receive a good deal more attention than is sometimes devoted to it.

In this connection the importance of the recovery of heat from the waste gases was early recognised by Messrs. J. Howden & Co., Ltd., who have applied their system to many steam ships and other power plant with very satisfactory results. What is claimed to be a further notable invention in this connection has just proceeded from the establishment of Messrs. Ljungström, of Stockholm, who have recently been developing the turbine-driven locomotive.

Messrs. Ljungström very early in their experiments realised that maximum economy could be obtained only by utilising the heat contained in the waste gases to an extent much greater than had been common before, and it was with this object in view that the Ljungström air preheater, fig. 1, was invented, and the principle lent itself readily to the design of preheaters for many types of furnaces, especially for those of steam boilers of all kinds; it is exceedingly simple and effective.

Briefly described, a large transmission surface is assembled in a rotating part in such a way that the elements are alternately traversed by the waste gases from the boiler and the cold air to be used for combustion. The gases give up their heat to the elements, and as the latter move round into the currents of cold air, the heat previously given up by the gases is taken up by the air, the process being continuous.

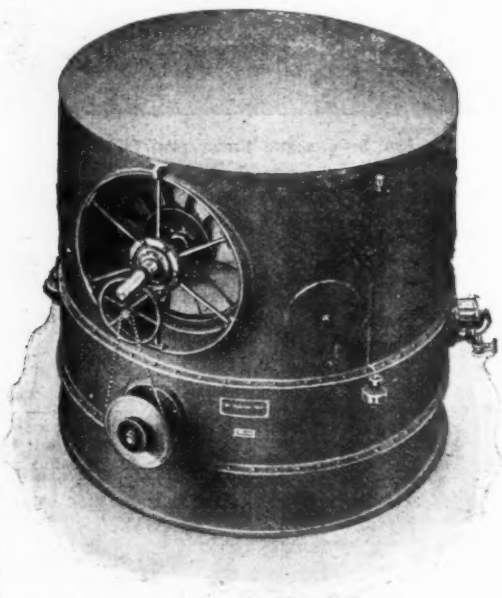

Fig. 1.—The Howden-Ljungstrom Air Preheater.

In actual construction the elements consist of thin plates of metal placed close together and corrugated in order to obtain a very large surface. They are fixed in the rotor, which is of disk form, in such a way that the passages for the gas and the air between the plates are parallel with the axis of rotation. The rotor is supported upon rollers carried in ball bearings fixed in a stationary cylindrical casing, so that the power required to drive the rotor is only a fraction of a horse-power.

In the sections above and below the rotor the casing is provided with inlets and outlets in such a way that the gases and the air traverse the rotor in opposite directions, and a counter-current effect is produced. The gases and air are separated from each other by diametral partitions in the upper and lower sections. In the upper section two fans are provided, one to force the cold air through the elements, which are at the moment travelling through the air side of the heater, and the other to suck the gases through the elements on the gas side. The two fans are mounted on one shaft that passes through the upper partition and can be driven by an electric motor or in any other convenient way, the rotor, which in all sizes revolves at a speed of 6 r.p.m., being driven by suitable gearing.

By this simple mechanism it is claimed to be possible to reduce the temperature of the waste gases leaving the boiler to a point hitherto regarded as impracticable. From 70 to 75 per cent., according to circumstances, of the heat contained in the waste gases can, it is said, be recovered, a result impossible with heaters of the ordinary type without a very large and costly extension of the surface, and a great increase in weight and in the space occupied.

An important feature of the heater is the ease with which the surfaces of the elements can be kept in practically their original clean condition. It is only necessary to fix a radial steam pipe, fitted with nozzles, below the rotor on the gas side to enable the surfaces to be cleaned thoroughly at convenient intervals. During each revolution of the rotor every portion of the elements must pass through the path of the steam jets below them, and no part of the surface of the elements can escape the scouring action of the steam; every particle of soot is blown away, so that the efficiency of heat transmission is maintained constant. It is necessary to operate the jets every few hours, but only for about 15 seconds, and the consumption of steam for this purpose is, therefore, negligible.

Messrs. James Howden & Co., Ltd., of Glasgow, assure us that they have made thorough trials of this apparatus in conjunction with their forced-draught system applied to a test boiler of the cylindrical marine type at their works, and the results have justified fully the claims made for it. The net efficiencies obtained with both coal and oil as fuels were in the neighbourhood of 90 per cent., a figure which represents a very considerable saving upon the best results hitherto obtainable, and a much greater saving compared with average practice.

Messrs. Howden have secured the exclusive rights for the application of this apparatus to marine work throughout the world, and have obtained a licence for land installations also.

LEGAL.

British Thomson-Houston Co., Ltd., v. Charlesworth, Hall & Co.

Counsel were heard by Lord Hunter in the Court of Session, Edinburgh, on July 31st in a note of suspension and interdict presented for the British Thomson-Houston Co., Ltd., against Charlesworth Peebles & Co., of Glasgow.

The complainers sought to interdict the respondents from removing or causing to be removed without the jurisdiction incandescent electric lamps at present in the respondents' possession or under their control which embody the improvements described in the complete specification filed relative to letters patent of which the complainers are grantees. The respondents do not manufacture electric lamps, nor tungsten wire filaments for these. They are, however, the selling agents for a Dutch company manufacturing in Holland incandescent electric lamps, and, complainers stated, the respondents have imported for sale within the jurisdiction incandescent electric lamps manufactured by the Dutch company or other foreign companies, and containing tungsten filaments embodying the improvements described in the complainers' specification.

The complainers, as the result of actions raised in the Court of Session against the respondents and the Dutch company, obtained interdict against them, including, *inter alia*, interdict against export of the lamps, and they also obtained a decree of delivery to them of all lamps infringing the letters patent referred to so far as in the respondents' possession or under their control. They believed and averred that respondents were in course of removing, or causing to be removed from the jurisdiction, lamps which were in their possession, and which infringed the letters patent. The complainers submitted that they were entitled to the delivery of these lamps.

Respondents, in their answers, stated that the lamps imported and sold by them did not infringe the alleged letters patent. They explained that they were advised and decided to reclaim against the interlocutors to which the complainers referred, and that they had informed the complainers' agent that a reclaiming note would be duly lodged. Pending the final judgment in the Court of Session, the respondents were following their ordinary course of business only, and maintaining the *status quo*. They had not returned lamps to Holland or dealt with them otherwise than in the ordinary course of business. They had offered to give an undertaking to deal with the lamps only on those lines, but the complainers had declined to accept any qualification which would permit dispatch to the North of England or Ireland in the ordinary course of business. In any event the complainers would not become entitled to delivery of any of the lamps in question. On the other hand, the restraint craved by the complainers would cause a serious dislocation of the respondents' business and business connections, and would

entail heavy loss to the respondents, for which, in the event of their ultimate success, the complainers would be legally liable, but which might not readily be capable of assessment in such manner as adequately to compensate the respondents.

Lord Hunter granted interim interdict, subject to the complainers amending their note to the effect of finding caution.

Theft of Electric Lamps.

At the West London Police Court, on August 3rd, Frederick Duncan, an electrician, was charged with stealing, by means of a trick, five electric lamps, valued at 30s., from Messrs. Lucas & Hudson, Notting Hill Gate. For the prosecution it was stated that in June last prisoner called at Messrs. Hudson & Lucas's shop and asked for the loan of two lamps for a job near by, presenting the trade card of an Ealing firm, and saying that he would replace them the following day. On the following day he replaced the lamps but borrowed five others, promising to replace them in a few days. He did not call again but was seen by Mr. Lucas, who gave him in charge, on August 2nd.

Answering the magistrate, Mr. Lucas said that it was the practice in the trade to oblige contractors by changing lamps for others of a different voltage. These were either exchanged or the lamps were paid for in a few days.

Previous convictions for larceny and false pretences having been proved, the prisoner was sentenced to four months' imprisonment, with hard labour.

REVIEWS.

Atomic Structure and Spectral Lines. By Arnold Sommerfeld. Pp. 626; 125 figs. London: Methuen & Co. Price 32s. net.

The third edition of the original German work, of which this is a translation, was a complete revision of the former editions, and this important book, now presented in English, embodies all but the very newest contributions to the rapidly-growing branch of science to which it relates. The translation for which Henry L. Brose is responsible has been done in a thoroughly workmanlike way. It was the expressed wish of the author that it should not be too liberal, and the translator was given discretion as to omissions and alterations: the book, no doubt, has benefited by exercise of this discretion, and the language is everywhere clear. A certain German heaviness, however, shows through in places; German ways of thinking are not ours, and a reader does not always receive the impression that the subject matter dealt with has been presented in the manner best calculated to economise the amount of attention it is necessary for him to give. The object of the book is to present a comprehensive account of spectral lines and their bearing upon the structure of the atom, such as to be within the grasp of non-academic readers. Hence abstract mathematical developments are either omitted or relegated to notes at the end of the book. These mathematical addenda nevertheless fill ninety-four pages, or nearly a sixth part of the volume.

The author begins with a retrospect of the development of electrodynamics, and devotes the whole of the first chapter, comprising fifty-five pages, to marshalling the prime facts upon which the science has been founded. This is done in a systematic and orderly manner which is distinctly illuminating, and this chapter should not be neglected, even by readers familiar with the facts, because it is always helpful, especially with a subject undergoing rapid growth, to go over its foundations from time to time, and verify the support they afford to the growing superstructure. Chapter II describes the natural system of elements. Chapter III opens with an account of Lane's discovery, and treats of Röntgen or X-ray spectra. Chapter IV is devoted to the hydrogen spectrum, the study of which has furnished the key to all, and in it the quantum theory is carefully explained. Chapter V deals with the modifications in the wave theory, which are introduced by the theory of quanta. Chapters VI and VII treat of series spectra in general and band spectra respectively, leading up to the eighth and last chapter, in which the theory of the fine structure is developed. This final chapter opens with a preliminary exposition of the theory of relativity, variability of mass, and inertia of energy in a way which is at once too much and too little; it is too much for one conversant with the subject, and not enough for one who approaches it for the first time: it was probably introduced with the object of making the book a compendium of all that was needed to cover the scope of its subject matter; but any one who desires to learn enough of the theory of relativity to understand its bearing on the radiation of energy, will have to supplement his studies from other sources. The requisite ideas are duly set out, but one must be already acquainted with them to know it. The whole theory of spectral lines has been based on the model afforded by the hydrogen atom, because in this we are dealing with the simplest case in which only two bodies are concerned: a problem that involves three bodies or more is often too complicated to solve. The possibility of penetrating into this new realm of the ultra-minute has been rendered possible by the extraordinary accuracy to which spectroscopic methods have been pushed; differences of wave length of $\frac{1}{4}$ in a million can be determined with certainty, so that even the far-famed "astronomic exactness" is approached if not surpassed.

By means of this wonderful instrument the universal constants, m the static mass of the electron, e its charge, h the quantum, may be obtained with the greatest accuracy. The book most fittingly closes with showing how, with statements of determinations arrived at and the limits of possible error. Spectroscopic facts have shown the inadequacy of classical mechanics, and proved the efficacy of the theory of relativity. It seems but a short time ago that Max Planck, after spending years of consistently planned work seeking to penetrate the realm of electrodynamics by the application of thermo-dynamic principles, greatly daring, ventured to advance his revolutionary hypothesis of energy quanta. He postulated that radiation of any frequency v can be emitted and absorbed only in multiples of n the elementary quantum of energy. $E=hv$. That was in December, 1900, when he gave his exposition of black body radiation to the Deutsche Physikalische Gesellschaft. It was received as fundamental innovations always are, and the resistance offered to it has not quite died out even now. But our author proclaims: "We hereby adopt the extreme view of the original Planck theory, according to which the quantum favoured states lie solely at the limits of the elementary regions, whereas the interior of these regions remains quite free from phase-points. These quantised states are distinguished from all other states of the system by characteristic whole numbers; they do not succeed each other but form a *network*. In the quantum orbits an electron moves, if undisturbed, permanently and without resistance, that is, without emitting radiation; the electron is thus, so to speak, rendered immune by the quantum condition as regards the emission of radiation." Elsewhere he states: "We need not think of a material substratum when we use the word ether; in our interpretation, the ether has no properties other than such as light itself possesses and such as arise out of the laws of the optical field."

In explaining the theory of quanta, the author, instead of confining himself to a special Planck oscillator, considers more generally *any arbitary mechanical system whatsoever*, or to begin with, any arbitary moving point-mass having one degree of freedom. He sets out $\int p\ dq = nh$. This integral to be taken along the orbit. The values of the co-ordinates q d p determine the state or *phase* (in Gibbs' terminology) of the system. He considers the definite formulation of the quantum hypothesis to consist of the postulate, that the "phase integral (the left member of the above equation) must be a whole multiple of the quantum h."

The "postulate of the author" is that the condition expressed in the equation applies to each individual degree of freedom of the system considered, that is, "we must postulate the value of the phase-integral for the k*th* degree of freedom, to be a whole multiple of h.

$$\int p_k\, d\, q_k = n_k\, h.$$

W. Wilson developed the same postulate from the law of heat radiation.

The phase-integral is necessarily a positive integer.

This is a good book for gaining a knowledge of spectral lines and intra-atomic physics. All the relations of the two are fully covered, and as the index is also good, it is a useful one to have at hand to refer to. Any feature of the subject to which reference is desired can be quickly turned up, and the inquirer may count upon finding a plain presentation of the information he requires without difficulty.

Simple Crystal Receiving Sets and How to Make Them.—Edited by Bernard E. Jones. Pp. 124; 114 illustrations. London: Cassell & Co., Ltd. Price 1s. 6d. net.

This is one of the "Amateur Wireless" Handbook series, compiled from the weekly journal of that name.

The construction of various simple receivers, including one which can be carried in the vest pocket, is clearly described, and there are also chapters on the construction of a crystal-valve receiver, a buzzer, and a wavemeter, as well as on the conversion of low resistance from high resistance telephones, a job not to be undertaken in a light-hearted manner.

Like the others in the series, this book invites the reader who comes up against difficulties to write for assistance to "Amateur Wireless," and like the others, also, it will certainly be found useful by those for whom it is written.

How to Make a Valve Receiving Set. By A. V. Ballhatchet, M.Inst.J.E. Pp. 42; 20 illustrations. London: Percival Marshall & Co. Price 6d. net.

This little book describes how to construct a straightforward valve set consisting of two valves, one used as a detector and one as a high frequency amplifier, covering the broadcast band of waves, and allowing for an easy extension if reception on longer waves is desired. The set described, if carefully constructed, should satisfy those who want something better than a crystal set, but do not wish to grapple with the complications of multi-valve arrangements.

How to Build Amateur Valve Stations. By P. R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E. Pp. 70; 70 illustrations. London: The Wireless Press, Ltd. Price 1s. 6d. net.

There is an increasing number of amateurs, both experimenters and "broadcatchers," who wish to take advantage of the large choice of component parts for valve receiving sets now on the market, as they know that by using these components intelligently excellent sets can be built up at small cost. The object of the book is to assist such amateurs, and it can confidently be recommended to them.

Chapters I and II deal simply with fundamental theoretical considerations in the use of valves; Chapter III is a description of the component parts which can now be purchased; Chapter IV describes the construction of aerials and earth connections; and Chapters V and VI give details of the construction of some simple units and complete sets.

Radio Telegraphie Telephonie Concert. By E. Reynaud-Bonin. Pp. 178; 88 illustrations. Paris: Gauthier-Villars et Cie. Price 10 fr.

M. Reynaud-Bonin, who is an engineer of the French Post Office and Professor at the Ecole Supérieur d'Electricité of Paris, writes with authority as well as with that lucidity which we expect from French text books. The book can hardly, however, be called a text book. It is intended to assist amateurs in understanding the working of their installations, and is therefore devoted mainly to non-mathematical explanations of receiving circuits, though a certain amount of information on transmitting arrangements is also given.

All information is up to date, and is set forth in a simple and concise manner.

The appendices which give regulations governing the use of wireless signalling in France will be of special interest at the present time to amateurs in this country.

Simple Valve Receiving Sets and How to Make Them. Edited by Bernard E. Jones. Pp. 124; 112 illustrations. London: Cassell & Co., Ltd. Price 1s. 6d. net.

This is one of the "Amateur Wireless" handbooks compiled from the writings of contributors to that journal, the name of the writer responsible for each chapter being given. The book deals with the construction of various types of single valve sets, a two and a three-valve set, and the "amateur wireless" unit set.

The information is given in a simple manner, and unnecessarily complicated circuits are avoided with success.

BUSINESS NOTES.

Bankruptcy Proceedings.—The British Radiophone Co., Downing Street, Bulwell, Nottingham, makers of wireless apparatus.—The public examination of Norman Williams, Mabel Williams and Walter Cook, who traded as above, was held on August 2nd, at the County Court House, St. Peter's Gate, Nottingham. Debtor, Norman Williams, stated that he entered into a partnership with his sister-in-law, Mabel Williams, and her father, Walter Cook, in August, 1922, as the British Radiophone Co. The only capital was that supplied by the last-named partner. Neither Mrs. Williams nor her father had any practical part in the business. Debtor was often away, and during his absence the business was managed by his brother. The business was formed with the idea of supplying wireless parts, and one of the causes of the failure was the inability to meet a large London contract because of the difficulty of obtaining the raw material. Although losses were being made debtor did not attempt to discontinue trading as he hoped that he might be able to pull round. An execution was levied and the effects were sold. The Official Receiver remarked that the case was most unsatisfactory. The cash account had only been received within the last 48 hours, and the goods account had not yet been lodged. He applied for an adjournment in order to make further investigations, and the case was accordingly adjourned.

Frank Percy Waltho and George Jellicoe Waltho, late 40, Union Street, Wolverhampton, company directors.—The adjourned public examinations of these debtors were held on August 1st at the County Court, Wolverhampton. According to the statement of affairs of F. P. Waltho, the gross liabilities amounted to £17,510, and there was a deficiency of £16,536. This debtor said the firm was registered as a limited company in 1908, and in 1912 was taken over by his brother, G. J. Waltho. They carried on business as builders' hardware merchants in Union Street, and St. James' Square, and since the war as manufacturers of electrical accessories. Debtor stated that his personal liabilities amounted to £724. As a result of proceedings by creditors the company went into voluntary liquidation last April. A scheme of reconstruction had been arranged which the creditors were prepared to accept, and in order to keep the business in existence the creditors had agreed to take debentures to the amount of their claims. They had also authorised the raising of £3,000 capital, the greater portion of which had already been promised. The business was being carried on, and so far had shown a profit. Debtor said that if the scheme went through the company would pay its debts and his financial position would be satisfactory. He would continue to act as manager of the company under the reconstruction, and to enable that to be done it was suggested that a composition to the creditors should be made, as if the receiving order were confirmed it would prejudice the company.

The statement of affairs of G. J. Waltho showed a deficiency of £15,801. This, debtor said that if the scheme went through, he expected to pay his creditors in full.

The examinations were therefore adjourned.

J. H. Whitehouse, electrical engineer, 61, Martin Street, Swansea.—First meeting, August 16th, at the Official Receiver's Office, Government Buildings, St. Mary Street, Swansea; public examination, August 10th, at the Town Hall, Swansea.

F. A. Pilbrow (H. & J. West), electrical engineer, 7b, Stoke Road, Gosport.—First and final dividend of 2s. 5½d. in the £, payable August 7th at the Official Receiver's offices, 87, High Street, Portsmouth.

William Percy Young, trading as W. P. Young & Co., electricians, of Sanvey Gate, Leicester.—This public examination was continued at the Leicester Bankruptcy Court on Friday last. Answering the Deputy Official Receiver (Mr. H. E. Foster) debtor admitted that his estimated trading deficiency during the last two years and four months prior to his failure was pure guesswork. His estimate was £2,101, and the filed statement of accounts provided since the last hearing showed a deficiency in the same period of £2,095. In closing the examination the Registrar commented on the loose dealings between bankrupt and his late partner. It seemed incredible that he had paid him out in the way he had. Debtor's position on his own admission was due to betting, and it was the only case he (the Registrar) could remember where a debtor had furnished an account of his betting transactions. If debtor had stuck to his original business he might have been successful. He had, unfortunately, turned his attention to other things, such as tannery machinery and the accessories business. It was the old story of a man trying to get rich quickly by going into other businesses. Those other businesses had brought debtor down. The electrical business in which he was originally engaged seemed up to a certain point to be very successful.

Company Liquidations.—Mitchell's Electrical and Wireless, Ltd.—A petition for the winding up of this company has been presented to the High Court by Messrs. J. Stone & Co., Ltd., creditors, and will be heard in London on October 16th.

Electro-Chemical Manufacturing Co., Ltd.—Meeting of creditors August 14th, at the Dean Hotel, 85, Oxford Street, W. Liquidator, Mr. G. E. McCaulis.

Calphos Electrical Co., Ltd.—Meeting of creditors August 10th, at Gow's Restaurant, 357, Strand, W.C.

Acme Electric Traction Co., Ltd.—A meeting of members is called for September 7th at 4, Charterhouse Square, E.C.1, to hear an account of the winding-up from the Liquidator, Mr. E. H. Hawkins.

James Scott, Ltd.—Winding up voluntarily. Liquidator, Mr. W. R. MacGregor, 5, Fenwick Street, Liverpool.

Connolly Bros., Ltd. (the old company).—Last day for proofs for dividend, August 22nd. Liquidator, Mr. I. M. Henderson, 2, Moorgate Buildings, E.C.

Dissolutions of Partnership.—Walker & Macbeth, manufacturers' agents, electrical contractors and merchants, 31a, The Arcade, Lord Street, and 27, Walter Street, Liverpool.—Messrs. A. O. Walker and W. T. Macbeth have dissolved partnership. Mr. Macbeth will attend to debts.

Albion Electric Co. (Hough & Walker), electrical maintenance and installation engineers, 112, Albion Street, New Brighton.—Mr. J. F. Hough and Mr. O. Walker have dissolved partnership. Mr. Walker will attend to debts.

Private Arrangements.—Harold Ewart Chesterton, electrical and oil lighting engineer, 13, Perry Road, St. Michaels, Bristol.—The creditors interested herein were called together recently, when a statement of affairs was submitted which showed ranking liabilities of £1,476, all of which were due to unsecured creditors. In addition there were fully secured creditors for £470, who held securities valued at a similar amount. The assets were estimated to realise £220, from which had to be deducted £28 for preferential claims, leaving net assets of £201, or a deficiency of £1,275. The assets consisted of: Stock-in-trade, £166, expected to produce £111; book-debts, £150, estimated to realise £97; furniture, £20; and fixtures, &c., £1 5s. It was stated that up to March, 1922, the debtor had acted as the district manager for a well-known firm. In October, 1920, he purchased the present premises for £630, paying £150 down, and leaving the balance on mortgage. The shop portion of the premises was sublet to his then employers at a rental of £2 a week, and subsequently negotiations were entered into by the debtor for taking over

the local portion of the business. That arrangement fell through in September last after the firm had supplied goods to the value of some hundreds of pounds, for which they were still shown as creditors. The debtor continued to act as the Bristol agent. The turnover for the seven months ended July last was about £600, with a gross profit of £100. The expenses had been heavy for the turnover, and the trading had resulted in a loss of £372 during the period. A resolution was passed confirming the deed already executed to Mr. J. D. Taylor, C.A., Baldwin Street, Bristol, while a committee of three of the principal creditors was appointed. The following are creditors :—

	£		£
Metropolitan-Vickers Electrical Co., Ltd.	60	Guiterman & Co., Ltd.	43
Western Electric Co., Ltd. ...	181	Kitson Empire Lighting Co. ...	20
Underwood (Manchester), Ltd.	71	Wrights, Ltd.	28
British Oil Stores	21	Jay's	43
Bristol A B C Guide	23	Ocean Accident and Guarantee Corporation, Ltd.	73
Blanchard Lamps, Ltd.	638	Phillips	60
British Petroleum Co.	41	Calphos Electric Co.	40
Compression Starter Co., Ltd. ...	20	Francis, W. B.	24

Trade Announcements.—The County Electrical and Wireless Stores, Ltd., 1, Broad Street Place, London, E.C., has opened a branch business at 1, South Street, Deal, with Mr. A. W. Bertie as manager.

Messrs. Stewart Bros. have commenced business as electrical engineers in Bridge Street, Dollar, Clackmannanshire.

The name of the Enfield Ediswan Cable Works, Ltd., has been altered to Enfield Cable Works, Ltd.

The Runbaken Magneto Co., Ltd., is opening a branch at 107, Northumberland Street, Newcastle-on-Tyne on Monday next. It is in charge of Mr. S. H. Flynne, a director, and fully equipped for magneto, dynamo, starter and accumulator repairs. This makes the company's tenth fully-equipped branch service depôt.

Messrs. Cobb, Webb & Co., Ltd., general electrical and radio engineers, have opened premises at 37, Tothill Street, Westminster.

Catalogues and Lists.—The Mills, Mines, and Engineers' Supply Co., 24, Pancras Road, N.W.1.—An illustrated booklet describing the "Helios" spring-making tool.

Messrs. Baxendale & Co., Ltd., Miller Street Works, Manchester.—List No. 3,272, containing prices of electric light and power accessories of all kinds.

The Anglo-Swedish Electric Welding Co., Ltd., Wood Wharf, Greenwich, S.E.10.—An illustrated report of tests carried out upon welds made by the Kjellberg system.

The Edison Swan Electric Co., Ltd., 123-125, Queen Victoria Street, E.C.4.—A pictorial showcard advertising "Ediswan" radio apparatus, batteries, and valves.

Messrs. Ferranti, Ltd., 180, Fleet Street, E.C.4.—Lists Fa. 75 and 76, containing illustrations and details of various applications of "No-Mag" non-magnetic cast-iron.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—August price list of electrical accessories, including lighting fittings, telephones, fuses, domestic appliances, &c.

Mr. George Ellison, Perry Barr, Birmingham.—List No. 17, containing illustrated descriptions of totally-enclosed air-break circuit breakers with magnetic blow-out.

The Lodge Fittings Co., Ltd., 57, Albert Road, Aston, Birmingham.—An illustrated price list of electric lighting fittings and accessories.

The Electric Construction Co., Ltd., Wolverhampton.—A folder describing and illustrating oil-immersed star-delta and auto-transformer starters.

Book Notices.—"Press-the-Button Telegraphy." By Donald Murray, M.A., M.I.E.E. (83 pp.; 28 figs.). London: The author.—This is a second edition of a collection of reprints from the *Telegraph and Telephone Journal* dealing with the Murray printing telegraph systems.

"Oil Flow-Velocity and Heat Transfer." By R. S. Danforth, A.M.Am.Soc.C.E. (17 pp. and 10 charts). San Francisco, California: The author.—This is a treatise upon the oils raised in the United States. The charts give average values for the viscosities of these oils at various temperatures, and heat transfer formulæ are given for use in the design of oil heaters, coolers, &c.

"Lighting Service: Factory Lighting Designs." (48 pp., ill.). London: The British Thomson-Houston Co., Ltd. *Gratis.*—This handbook contains a great quantity of illuminating engineering data applicable to factories of various sizes.

The "Model Engineer" Series. No. 48, "Gear Wheels Simply Explained," by A. W. Marshall, M.I.Mech.E. (63 pp.); No. 49, "Screw Cutting Simply Explained," by G. Gentry (63 pp.); and No. 50, "Clock Repairing and Adjusting," by W. L. Randell (68 pp.). London: Percival Marshall & Co. Price 9d. each.

"Science Abstracts." Vol. 26, Part 7. No. 307. Section A.—Physics; and Section B.—Electrical Engineering. London: E. & F. N. Spon, Ltd. Price 3s. per section.

Technologic Paper No. 237 of the U.S. Bureau of Standards, "Aeronautic Instruments" (65 pp.; 58 figs.). Washington: Government Printing office. Price 20 cents.—This contains brief descriptions of instruments for indicating altitude, speed, and orientation, pressure gauges, navigating instruments, &c.

"Physics in Industry," Vol. I. by Archibald Barr, D.Sc., Sir J. A. Ewing, K.C.B., and C. C. Paterson, O.B.E. (59 pp.). London: Henry Frowde and Hodder & Stoughton. Price 2s. 6d. net.—This is the first of a series of lectures delivered under the auspices of the Institute of Physics. These were reproduced in our columns in abstract form at the time of their delivery. Sir J. J. Thomson, O.M., F.R.S., contributes a foreword in which he points out the growing realisation of the importance of the work of the physicist to industry, but stating that there is still much more to be done in the way of establishing research laboratories and in many other ways.

"A Text-Book of Light" (Tutorial Physics, Vol. III). Edited by R. Wallace Stewart, D.Sc.; revised and enlarged by John Satterly, D.Sc. (Fifth edition). Pp. 362; 210 figs. London: University Tutorial Press. Price 6s. 6d.—The only alteration in the last edition of this useful text-book is the addition of a chapter on "Polarisation," by Mr. A. W. Humphreys, B.Sc.

"The *Journal* of the Junior Institution of Engineers." August. London: Percival Marshall & Co. Price 2s. Two papers are reproduced in this issue: "The Heavy Oil Engine: with special reference to Marine Work," by J. Calderwood, M.Sc.; and "The Ventilation and Natural Lighting of Buildings," by P. J. Waldram, F.S.I. In addition there are notes of proceedings at local sections and reports of visits, &c.

"The *Transactions* of the South African Institute of Electrical Engineers." June, 1923. Price 2s.—Three "wireless" papers are reproduced in this issue: "Some Methods of Automatic Wireless Reception," by A. H. E. Rogers, A.M.I.E.E., &c.; "A Description of a Modern Receiving Equipment," by E. E. Barnett; and "A Few Notes on Oversea Wireless Stations heard in Johannesburg," by S. C. Pleass.

"Shopkinks," by R. Grimshaw. Sixth edition. Pp. 417. Price 18s. net; "Practical Tests for the Electrical Laboratory." by C. H. Johnson and R. P. Earle. Pp. vii+347; figs. 64. Price 16s. net. London: Constable & Co., Ltd.

Canadian Industries.—A seasonal slackening in the volume of new building undertakings is recorded in the report of building permits issued in Canada for the week. Meanwhile contractors are pushing work actively on structures now under way so as to complete exteriors while favourable weather continues. Contractors for the larger engineering projects, such as water power and electrical development, pulp mills and grain elevators, are also well forward with operations, and several new works of considerable magnitude have been launched. The prevailing buoyancy in the iron and steel market is contributed to in no small degree by the foresight of manufacturers of agricultural implements in anticipating the enhanced demand for agricultural implements created by the prospects of an abundant grain harvest. The output of this class of machinery will apparently reach a very high record for 1923. Mining machinery continues to be in active demand. In the Ontario gold fields, which last year produced more than twenty million dollars' worth of fine gold out of a total production of twenty-six millions for the whole Dominion, the larger corporations are planning extended workings and acquiring hydro-electric power for ore treatment and production. Railway production is proceeding apace and the check to optimism for the future which followed the refusal of the Senate to sanction the Government's long-term programme has proved to be but temporary, the directorate of the Canadian National system having determined to proceed with necessary branch line construction under corporate financial arrangements. Large orders for freight cars and other equipment are being placed by the Canadian railways with Montreal and Western shops, all of which, as well as the rail and pig-iron production plants in Ontario, are working to capacity.—*Reuter's Trade Service* (Ottawa).

For Sale.—Edmonton Urban District Council invites offers for five "Orwell"-type electric dust vehicles and charging plant. Dublin Port and Docks Board invites offers for the existing generating plant, comprising four Parsons steam turbines, direct coupled to d.c. dynamos, one Highfield reversible booster-balancer, three Babcock & Wilcox water-tube boilers, switchboard, &c. Liverpool Corporation Electricity Department has for disposal two 350-b.h.p. B.T.H. Curtis-type turbos. The Air Ministry invites offers for surplus generating plant, oil engines, &c., lying at the Lympne and Hawkinge Aerodromes. (See our advertisement pages.)

Another "Story."—An electrical contractor joined the majority and applied upstairs for a harp and crown. He was refused admission. He then went downstairs and applied for admission, but was again refused. Whereupon he wandered away into space and, sitting down upon an atmospheric, burst into tears. Another wandering spirit approached him and said: "Brother, why these tears?" "Why these tears?" he replied, "I didn't expect to get in upstairs; but now they won't let me in downstairs, so I shall have to go back to earth again *and be an electrical contractor.*"—*The Electrical Contractor.*

Scottish Electricians' Wages.—The Industrial Court has made an award fixing new rates for employés of Scottish electricity supply undertakings. For skilled workers the new rates are as follows:—Group A, 1s. 4½d. per hour; Group B, 1s. 4d.; and Group C, 1s. 3½d. Further charges are to be regulated by the cost-of-living index figure. An annual holiday of six days, with pay, per annum is included.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—August 31st to September 22nd, Shipping, Engineering, and Machinery Exhibition; September 8th to 14th, Bakers' Exhibition; October 15th to 20th, Motor-Cycle and Cycle Show; November 22nd to December 1st, Motor Exhibition; April 28th to May 9th, 1924, British Industries Fair.

BIRMINGHAM.—May 12th to 23rd, British Industries Fair.

CZECHO-SLOVAKIA (*Prague*).—September 2nd to 9th, International Samples Fair.

BELGIUM (*Namur*).—September 1st to 17th, Commercial Fair.

FRANCE (*Paris*).—November 30th to December 17th, Physical Science and Radio Exhibition.

HAVANA.—February 9th to 24th, International Samples Fair.

HOLLAND (*Utrecht*).—September 12th to 25th, Industries Fair.

ITALY (*Turin*).—September 8th to 30th, Patents and Industrial Improvements Exhibition. (*Naples*).—September 16th to 30th, International Industries Fair.

JAPAN (*Osaka*).—September 12th to October 20th, Communication and Travelling Exhibition.

JUGO-SLAVIA (*Ljubljana*).—September 1st to 10th, International Trade Fair.

NORWAY (*Christiania*).—September 2nd to 9th, Industries Fair.

TRIESTE.—September 3rd to 24th, International Samples Fair.

URUGUAY (*Montevideo*).—December, Industries Exhibition.

Hungarian Electrical Exports.—Statistics showing exports of electrical material from Hungary during the first quarter of 1923 indicate that the greater percentage of this material is going to countries immediately adjacent to Hungary. A total of 5,890 metric tons was exported, of which 18.6 per cent. went to Italy; 17.8 per cent. to Rumania; Austria, 7.3 per cent.; Germany, 14 per cent.; Yugo-Slavia, 7.6 per cent.; and all others, 34.7 per cent.—*Commerce Reports.*

Austrian Lamp Industry.—According to the United States Trade Commissioner in Vienna, a leading factory manufacturing electric lamps in Austria, Hungary, and Czecho-Slovakia reports that it is "Americanising" its works. The Austrian factory is now turning out about 30,000 lamps per day, the Hungarian factory about the same, and the Czecho-Slovakia factory about 5,000 a day.

Electro-Metallurgy in Brazil.—*Commerce Reports* states that the Companhia Metallurgica Brasileira of Ribeirao Preto, Sao Paulo, which is attempting to make steel by means of the Swedish electrical process, has announced that its high-power electric furnaces have successfully begun operations. This company is subsidised to the extent of 5,000,000 milreis by the Brazilian Government.

Local Exhibitions.—THE ROYAL LANCASHIRE SHOW.—There were many electrical exhibits at this show, held in Liverpool from August 2nd to 6th. Sir W. G. Armstrong, Whitworth and Co., Ltd., had a very compact stand, of which the principal feature was small lighting sets belt driven by 2-stroke oil engines. Electric washing machines, vacuum cleaners, irons, bed warmers, hair dryers, and boilers were exhibited by the Northern Steel and Hardware Co., Ltd. (Manchester). Electrically-driven compressors for refrigeration and ice-making installations were shown by Messrs. Higginson & Co. (Liverpool); and electric lighting plant and electric pumps were demonstrated by Messrs. Boulton & Paul, Ltd. Other exhibits were:—Delco Light Co., small lighting and power plant; Messrs. E. M. Bates, Ltd. (Manchester), electric washers, ironers, vacuum cleaners, &c.; Liverpool Electrical Engineering Co., Ltd., country house and farm lighting sets, electrical apparatus, and fittings; Alfred Williams & Son (Preston), Petter engines, pumping, and electric lighting sets, "White Cap" washing machines, and wireless sets; the Magnetic Separator Co., "Cascade" magnetic separators; and "Gem" electric washing machines.

Lead.—Messrs. James Forster & Co. state that the stocks of lead in official warehouses, according to Metal Exchange statistics, show an extraordinary rise during July of 1,652 tons, this during a period when the dockers' strike prevented steamers from discharging!

Electrification of Irish Paper Mills.—The Swift Brook Paper Mills at Saggart, Co. Dublin, are in course of electrification. A new power house has been erected, and the old steam plant and shafting are being replaced by electric motors.

Railway Electrification and Unemployment.—The recent letter to the Prime Minister from the Industrial Group of M.P.'s headed by Sir Allan Smith puts before the Government concrete proposals for the relief of unemployment by the construction of reproductive works. Amongst the recommendations are an immediate beginning with certain railway electrification schemes already approved in principle by the companies. These include (1) on the Southern Railway, the extension of the L. & S.W. section electrification, completion of the suburban electrification of the L.B. & S.C. section and electrification of the main line to Brighton. (2) On the L. & N.E.R. electrification of the Great Eastern suburban section, and of the main line from York to Newcastle. (3) On the L.M.S., the electrification of the direct line to Southend. In all, these proposals are estimated to cost between 40 and 50 millions sterling.

The companies are fully alive to the importance of these schemes, which will in the long run become indirectly, if not directly, remunerative, but they are not prepared, unaided, to face such a large outlay at present. The money could be raised, even without a Government guarantee of interest, but only at a rate in excess of the 3 or 4 per cent., which would be the maximum return anticipated on this total outlay. If the Government, which is prepared directly to assist municipal and port authorities in carrying out public utility schemes, would make a grant of one-third of the cost of these proposed electrifications, these extensive schemes could be set going very shortly.—*Railway Gazette.*

South African Trade: Bankrupt Stocks Imported and Auctioned.—We wish to draw the attention of traders to the following quotation from the half-yearly report of the British Manufacturers' Representatives' Association of South Africa (Inc.), which has just come to hand:—"Importation of new goods for sale by auction.—The pernicious practice adopted by certain auctioneers or dealers in importing cheap bankrupt or other stocks from abroad and auctioning them on this market to the serious detriment of representatives and legitimate importers has had the close attention of your Council and the Johannesburg Committee. There appears to be no way of checkmating this evil so far as the existing licence laws are concerned, while the difficulty with which the Customs authorities are faced is that the goods are invoiced at the true home-consumption value whatever may actually be paid for them. Consideration is therefore being given to the question of representations to the Government with a view to the introduction of suitable legislation. In the meantime, as information is to hand that at least one leading firm of London shippers is regularly supplying goods to an auctioneer in this country for disposal, home trade journals who receive a copy of this report may consider it desirable to draw attention to the damaging effect of such shipments on the business of regular importers."

Message from the New President of the E.C.A.—In the August issue of the *Electrical Contractor*, Mr. R. Robson, the new president of the Electrical Contractors' Association, issues a message to all members of that Association and of the N.E.C.T.A., Ltd., and the N.F.E.A., in the course of which he says:—"Last year our N.E.C.T.A. Trading Policy was published; it was a superb piece of work. Your thanks are due to those past-presidents and Mr. Riggs (vice-president) for such an able outline of our aims as regards trading. Now it remains to see that our views on trading are put into operation. During my year of office I hope to see a considerable advance in methods of trading greatly to our benefit. By using our defined trading policy it can be done.

"The municipal showroom is a question which requires considerable attention and study. In several branches co-operative working arrangements have been entered into. But we require a definite policy on this question as well as in trading: and a committee has been formed to gather information and define our policy. But I consider the most important point appertaining to this question is for our members to do their duty and to be first on the scene. To open their own shops and showrooms and allow no corporation engineer to be in a position to say that his consumers are unable to see, and have demonstrated to them, electrical apparatus unless the corporation itself opens a showroom.

"An important matter that will come before branches shortly is the question of indenturing boys. The Council has passed a standing order allowing any branch, if they think fit, to compel all members of that particular branch to indenture all their boys. It is believed by the Council that if a branch adopts this system it will prevent, to a great extent, work being carried out mainly by boys and thereby relieve undercutting.

"With regard to undercutting, I want to try and reduce this as far as possible, and I think it can be done. I would like to see our financial status raised so as to get a legitimate profit for our work. It is proposed, later on, to lay before members a system of cost-keeping mainly to show proper allowances for standing charges on various items and how certain items vary as to standing charges to others. One of our committees is at present going into the matter. It must be thoroughly understood that the stupid system of quoting and charging on the 'per point' basis must be wiped out entirely. This 'so much a point' business has been a curse to the trade. I look forward to the time when all architects will send out electrical quantities the same as plumbing quantities—to a time when we shall not be amazed when we see them as we are now.

"Registration being now an accomplished scheme and, except for legal formalities, ready to be put into operation, we are hoping that it will greatly improve the status of the trade, reduce jerry work considerably, and so allow our members a better innings."

Wire Lamps in Germany.—The Wolfram Lamp Company, of Augsburg, the majority of whose shares are held by the Berlin Osram Co., has just declared a dividend at the rate of 50 per cent. on the ordinary shares. At the recent general meeting it was stated that the reconstruction of the factory had been completed and the manufacture of lamps resumed. It was expected that the maximum limit of production would be reached in a few months.

Overseas Development Schemes.—The Secretary for the Colonies has appointed a committee, with Earl Ronaldshay as chairman, to consider whether, and if so what, measures could be taken to encourage private enterprise in the development of the British Dependencies, with special reference to existing and projected schemes of transportation; and to report to the Secretary of State for the Colonies.

Orders for Skoda Works.—According to a report from Prague, the Skoda Works have concluded further important business transactions, and there is particular activity in the electro-technical department, the products of which find favour in foreign markets, especially in the Far East. According to the report, Corea, China, and Japan have given such orders as will guarantee employment to the Skoda Works for a long time to come. These orders concern more especially turbo-generators of 1,000 h.p. The electro-technical department is preparing plans for the electrification of Lithuania, and is also participating to a considerable extent in the electrification of the district of Pilsen, and will probably take part in the electrification of the Pilsen-Zdice railway.

Holidays.—The works and offices of the BRITISH EBONITE CO., LTD., at Hanwell, are closed until Monday next for the annual holidays.

Unemployment.—The "live" registers of the Employment Exchanges on July 23rd showed a total of 1,184,900 persons as wholly unemployed; part-time workers numbered 62,100. These figures were respectively 4,239 more and 3,488 less than those of the previous week. Since the beginning of the year the total number of unemployed has decreased by 301,000.

Battery Vehicles in France. — The Société pour le Développement des Vehicles Electriques is reported to have been formed in Paris with a share capital of 1,400,000 fr. to promote the use of secondary batteries in all kinds of vehicles. Among the founders appear the names of the Compagnie Parisienne de Distribution, the Electricité de Paris, and other electricity supply undertakings.

Germany: Our Need to Equalise the Industrial Handicap.—The *Manchester Guardian Commercial* says:—In order to escape in part the loss of capital entailed by the holding of marks, German industrialists have invested it in new capital works. That is to say, they have built new factories and equipped them with up-to-date machinery often far in excess of current demands. Also as a result of the fall in the mark, they have been able to escape from a considerable portion of their interest charges by the repayment of debentures. Whatever the capacity of Germany as a whole, it is clear that individual concerns in the position described above would be in a position to compete favourably with concerns in this country where these charges have still to be met, and where it will probably be discovered, when the long-deferred revival takes place, that the passing of some years "on the dole" has considerably lowered the standard of British labour. It therefore seems clear that in self-defence we must not allow the industries of Germany to go free, quite apart from any moral or equitable claims which we may have to reparation. But these contentions would be strengthened rather than weakened if France, in pursuance of motives, which appear to be very largely political, were to cause, willingly or unwillingly, a breakdown in Germany and a *rapprochement* between the principal industrial areas of that country, namely, the Rhineland and the Ruhr and the industrialists of the Franco-Belgian coalfield. If, on the contrary, these areas were involved in a general break-up of Germany, then for the time being we should be rid of a powerful competitor; but it is by now generally conceded that the economic collapse of Central Europe, which would certainly result, would mean that a further large section of our market would have temporarily disappeared. The only remaining course—a course which it is clear this country should adopt—is to press for what may be called, for want of a better expression, the equalisation of the industrial handicap.

LIGHTING AND POWER NOTES.

Bath.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £7,860 to cover excess expenditure in respect of the installation of a turbo-generator and other machinery and extensions to buildings.

Billingham.—ELECTRICITY SUPPLY.—The Urban Council is communicating with the Synthetic Ammonia and Nitrates, Ltd., with regard to a supply of electricity for the town.

Blackpool.—ELECTRICITY IN BULK.—The Town Clerk has been authorised to prepare an agreement with Lytham-St. Annes respecting a bulk supply of electricity to the latter authority. Application is being made to the Electricity Commissioners for sanction to the proposed agreement and also to borrow £10,000, the estimated cost of the cable extensions.

Canada. — HYDRO-ELECTRIC DEVELOPMENT. — The Sinclair Construction Co., of Campbellford, Ontario, has been awarded the contract for building the new power house at Campbellford for the Ontario Hydro-Electric Power Commission, at a cost of $250,000. The machinery to be installed will cost over half a million dollars.—*Reuter's Trade Service* (Toronto).

Greetland.—LAND PURCHASE.—The Urban District Council has received a communication from the Electrical Distribution of Yorkshire, Ltd., asking it not to exercise its rights of purchase of the company's land in Greetland, the option on which expires in 1934. The company intimated that up to the present the return on the large amount of capital spent in the district was very small, and if the company's request were acceded to, extensions would be proceeded with at an early date.

India.—KALLAR RIVER HYDRO-ELECTRIC SCHEME.—It is understood that a conference will be held between the representatives of the Travancore Durbar and the Revenue and Irrigation Members of the Madras Government regarding the project elaborated by the Durbar, in consultation with certain English engineering firms, for harnessing the Kallar River. The Durbar's idea is to have electrical works on the British side, where the fall is greater, and convey the power generated there to Travancore to be utilised for industrial and lighting purposes. The discussion will be for the purpose of making mutual adjustments of rights between the two Governments and fixing the compensation to be paid by the one party to the other for putting the scheme through.—*Reuter's Trade Service* (Bombay).

Indo-China. — WATER-POWER DEVELOPMENT. — The U.S. Consul at Saigon reports that applications have been made by two companies for the right to utilise the falls of Song Nam in the Tonkin mining region for power in connection with tin and zinc reduction. It is planned to use 14,000 h.p. in an electro-metallurgical plant.

Irish Free State.—KINGSTOWN.—The Irish Free State Ministry of Industry and Commerce recently held an inquiry at Kingstown into the Urban Council's application for a loan for the carrying out of a scheme of electric lighting and the erection of a generating station. It was stated that the scheme was favoured by the townspeople. Objection was made by the proprietors of a hotel at Tatthill that the erection of the generating station at the West Pier would have an injurious effect on the hotel owing to the fumes.

Kettering.—YEAR'S WORKING.—The electric lighting accounts (subject to audit) for the year ended March 31st last show that the income of the undertaking (engineer: Mr. W. A. Walker) was £36,355, as compared with £37,293. The working expenditure amounted to £19,435, as against £20,714, the gross surplus being thus £16,820 (£16,579). Capital charges were higher, reducing the net profit from £5,618 to £4,435, of which £500 was refunded to the district rate, and £1,725 employed for capital purposes. The capital account shows an expenditure of £13,209, the bulk of which was due to mains and services. The sales of energy increased from 3,035,475 to 3,600,497 kWh.

Kirkwall.—ELECTRICITY SUPPLY.—The Town Council has in hand a scheme for supplying electricity in the town. The generating station at Kirkwall is in course of erection, and the cable laying commenced last week. The supply will be at 220 and 440 V on the three-wire system.

Lanarkshire.—SPECIAL ORDER.—The County Council has consented to an application of the Strathclyde Electricity Supply Co. for a Special Order for the supply of electricity to certain districts in the county.

Liverpool.—NEW PLANT.—The City Council is to proceed with the scheme for the extension of the Lister Drive power station by the provision of a new 2,500-kW generating set. It was pointed out that even if a joint electricity authority were set up, the additional plant would be required. The undertaking is now practically debt free.

London.—POPLAR.—*Year's Working.*—The accounts of the borough electricity undertaking (engineer: Mr. J. H. Bowden) for the year ended March 31st last, which are subject to audit, show a total income of £168,718, as compared with £182,092 in the previous year. The working expenditure decreased from £131,795 to £103,726, leaving a gross surplus of £64,992, as against £50,297. This was carried to the net revenue account together with other balances, making £66,654 available (£50,730). After the payment of loan redemption, interest, &c., a net profit of £12,158 was shown, nearly double that of the previous year (£6,237). A total of £10,720 was spent out of this surplus on capital account, and, in addition to this, an expenditure of £49,847 was made from loans. The number of kWh sold increased from 22,526,506 to 27,556,971, and the maximum demand from 9,700 kW to 12,000 kW, the plant capacity remaining stationary at 16,000 kW.

STEPNEY.—*Year's Working.*—The accounts of the municipal electricity undertaking (engineer: Mr. W. C. P. Tapper) for the year ended March 31st last record a total revenue of £278,807, as compared with £257,252. Working expenses amounted to £141,741, as against £168,922, leaving a gross profit of £137,066 (£88,330). Thus, although the capital charges increased by approximately £12,000, there remained a net surplus of £65,645, as compared with £28,388 in 1921-22. The bulk of this (£46,652) was utilised to write off the value of non-existent assets from the capital account. This account shows an expenditure during the year amounting to

£58,556, including £27,542 for mains and £13,529 for services. The following figures, showing the additions to services made in each of the past four years, indicate the rapid growth of the undertaking:—1919-20, 353; 1920-21, 502; 1921-22, 823; and 1922-23, 1,380.

The production statistics show that 34,418,923 kWh was sold, as compared with 27,888,661 kWh in the previous year. The maximum demand rose from 13,850 kW to 16,710 kW, while the plant capacity was increased from 16,000 kW to 23,500 kW.

Malvern.—Loan.—Application has been made to the Electricity Commissioners for sanction to borrow £11,000 for the extension of the electricity works, and negotiations are to take place with a view to obtaining a bulk supply of electricity from Worcester.

Northern Ireland.—Belfast.—The Duke of Abercorn, Governor of Northern Ireland, has consented to open the new power station at the Harbour on August 15th.

Price Reductions.—Reductions in the charges for electricity are being made in the following districts:—

Shrewsbury.—Electricity for all purposes from 60 per cent. to 50 per cent. above the pre-war rate.

Perth.—Lighting: From 6½d. to 5½d. per kWh, with corresponding reductions to large consumers. Power: Reduced to ½d. per kWh.

Reigate.—Electricity in Bulk.—The Town Council has given instructions for a report to be prepared of the probable cost of giving a bulk supply of electricity to Horley and district.

Rochdale.—Extension of Supply.—The Corporation has agreed to extend its electricity supply system along Edenfield Road to Millbridge, at the request of, and subject to a minimum annual payment being guaranteed by the Norden Urban District Council.

South Africa.—New Johannesburg Power Scheme.—The Department of Overseas Trade states that the Senior Trade Commissioner in South Africa reports that the Johannesburg Town Council has now voted in favour of the proposed new power station. It also recommended that, in the period which must elapse before the new power station is completed, a 10,000-kW generator adaptable to the new conditions should be installed in the old power station on temporary foundations, to be afterwards removed to its permanent position in the new station, and that the matter should be treated as urgent, in order to have the set running before the winter of 1925. The total cost of the new station will be about £500,000; it will be equipped with two 10,000-kW generators, together with two generators from the old station, so as to give a capacity of 39,000 kW. Messrs. G. M. Clark & Partner have been appointed consulting engineers. The Finance Committee has also recommended the erection of this power station, provided that authority is obtained from the Administrator to borrow an amount of £525,000.

Wellington (Cape Province).—It has been decided to proceed with the erection and equipment of a new generating station at a cost of £51,000. Plant with a capacity of 1,000 h.p. is to be installed.

St. Helens.—Annual Report.—In his notes upon the annual report upon the electricity undertaking, the borough electrical engineer (Mr. F. N. Rendell Baker) states that the net profit increased from £6,310 to £8,621 notwithstanding a substantial reduction in charges bringing them down to 50 per cent. above the pre-war level. He mentions that a further reduction is to be made to lower the percentage increase to 35. The thermal efficiency which at 11.7 per cent. was reported to be the highest of any station in the Mersey and West Lancs. Electricity District, was improved to 13.14 per cent. in 1922-23.

Tunbridge Wells.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £53,200 for extensions to the plant at the generating station.

Walsall.—Electricity for Gasworks.—The Electricity Committee has decided to extend the mains in the centre of the town, and in Pleck and Caldmore, at an estimated cost of £1,030. The Pleck extensions are being carried out so that electricity may be applied to the gasworks for power purposes to drive new machinery there. The Town Council has sanctioned the extensions.

Warrington.—Electricity Order.—Application is to be made to the Electricity Commissioners for a Special Order authorising the Corporation to supply electricity to Orford, Paddington, Padgate, and Winwick.

Wellesbourne.—Electricity Supply.—The Warwickshire County Council has consented to the application of the Barford Electric Supply Co., Ltd., for permission to extend its mains to the district.

West of Scotland.—Proposed Electricity Board.—A meeting will be held at the City Chambers, Glasgow, on September 7th, to consider a scheme for the constitution of a joint advisory board for the West of Scotland Electricity District, at which representatives of various local authorities and companies affected will attend.

Willesden.—Year's Working.—During the year ended March 31st last the electricity undertaking (engineer: Mr. A. W. Blake) received an income of £108,812. The working expenses amounted to £68,780, leaving a gross surplus of £40,032. In the previous year the equivalent figures were: Revenue, £101,967; expenditure, £74,112; surplus, £27,855. Although the capital charges were higher by about £7,000, the net profit showed an increase of £10,474 to £17,627. A sum of £1,569 spent for capital purposes was charged to revenue, and, in addition, the capital account shows an expenditure of £36,518, the largest single item being £17,607 for mains and services. The sales of energy increased from 8,160,940 to 9,507,066 kWh.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Proposed Railless Cars.—The proposal of the Corporation to run railless cars between Ashton and Oldham has been favourably considered by the Oldham Corporation Tramways Committee. The proposal has been made owing to the heavy cost that would be involved by the reconstruction of the existing tramway track.

Bolton.—New Routes.—The Tramway Committee has approved of the laying of a double line of tramways along Bridgman Street, from High Street to St. Philip's Church, and of an additional loop near the Doffcocker Hotel on the Chorley Old Road route.

Continental.—Italy.—The Milan Town Council has accepted the offer of a Franco-Spanish group already holding a concession for the Genoa Tube Railway for the construction of an underground railway. The first trunk is expected to cost 150,000,000 lire and will be begun before November and completed within three years. Initial traffic is estimated at 20,000,000 passengers.—*Financial Times.*

Leicester.—Tramway Improvements.—The Tramway Committee has in hand a number of schemes for improving its system. It is proposed to enlarge the tramway depôt, improve the East Park road route at a cost of £20,000, construct new lines along Abbey Park Road and Blackbird Road, and renew the overhead equipment.

Liverpool.—New Car Depot.—The City Council has decided to erect a new tramcar construction and repair depôt capable of dealing with over 200 tramcars at the same time. Plans have been prepared for the conversion of a building in Edge Lane, and the work will cost over £200,000. The Lambeth Road depôt for tramway repairs is to be superseded. It is intended to provide facilities for instruction in driving and the construction of cars.

Manchester.—Loan.—The Tramway Committee proposes to apply to the Ministry of Transport for sanction to borrow £30,000 to cover the cost of doubling the track and providing sidings in certain districts.

New Zealand.—Inauguration of Otira Tunnel.—The Prime Minister of New Zealand performed the opening ceremony of the Otira Tunnel on August 6th. The tunnel passes through the Southern Alps for a distance of over five miles and forms a junction between the West and East Coast railway systems. The railway is electrically operated for a distance of eight miles, the terminal stations being Arthur's Pass and Otira. The electrification work was carried out by the English Electric Co., Ltd.

West Hartlepool.—Railless Cars.—The Corporation has before Parliament a Bill authorising it to substitute railless cars for the present system, and to run these over new routes. It is estimated that the change-over will cost £3,000 per mile, as against an estimated cost of £13,000 per mile for track renewals.

TELEGRAPH & TELEPHONE NOTES.

China.—Radio-Telegraphy.—A message from Kashgar dated June 20th announces the completion of the Marconi radio station at that place. It will be remembered that a contract between the Chinese Government and Marconi's Wireless Telegraph Co. for the erection of three stations at Lanchowfu, Urumchi, and Kashgar, linking up with Peking, was concluded in 1919. Later it was decided that the first station should be erected at Urca instead of Lanchowfu. The second station, located at Urumchi, was completed last year, and now the third, at Kashgar, has been successfully completed. There being no proper roads across the continent, the apparatus had to be packed so that it could be transported by camel, and it is interesting to note that the enormous amount of material, including such heavy material as cement, has been transported without serious loss or inconvenience.—*Reuter.*

Cables to the Far East.—The through route of the Indo-European Telegraph Co. from the United Kingdom was re-opened for telegraph traffic with South Russia, Turkey in Europe and Asia, Persia, Persian Gulf, Iraq, India, and the Far East on August 3rd.

Mexico.—Long-Distance Telephony.—A long-distance telephone line between the city of Chihuahua and Ciudad Juarez, opposite El Paso, has just been opened. The line, which is about 223 miles long, will have one intermediate station at Villa Ahumada. It is the intention to establish a connection with the American telephone system at El Paso, and it is hoped that the transmission qualities of the new line will be good enough to permit general communication with the larger cities of the United States.—*Commerce Reports.*

Netherlands.—Automatic Telephony.—Developments in the telephone field indicate the adoption of a completely automatic system in all the principal cities of the Netherlands in the near future, says *Commerce Reports*, which reports that some switchboards, which originally came chiefly from the Ericsson establishment and are widely different in construction, are being rebuilt to meet the needs of the fully automatic system. Exchange equipment of American manufacture has been installed in more than one exchange, particularly where there is an increasing use of private lines and installations. There has been a marked development in the use of the telephone in the Netherlands during the past year. Services in the various cities have improved greatly, and much has also been done to improve long-distance telephone service with other cities of Europe.

River Plate.—Telephone Concession.—A decree of the National Government authorises the Compañía Sudamericana de Teléfonos L. M. Ericsson, S.A. to install and exploit a public telephone service, inter-urban and urban, between the Provinces of Corrientes and Santa Fe, with stations in the cities of Reconquista and Goya.—*Review of the River Plate.*

RADIO-TELEGRAPHY AND TELEPHONY.

Germany.—Radio Letters.—The Federal Postal Administration has instituted a system of radio-letter exchange between Germany and the United States. Letters will be received for transmission at any telegraph office and will be sent to New York when the lines are clear of ordinary and Press traffic. From New York the letters will be forwarded by mail.

Imperial "Wireless" Chain.—New Station Site.—The site for the group of stations to be erected by the Marconi Co. in connection with the Imperial "chain" of radio telegraph stations has yet to be approved by the Postmaster-General, but should present plans mature, says *The Times*, it will be at Avebury, in Wiltshire, which is regarded by archæologists as the finest prehistoric site left in Europe. The matter has been reported to the Ancient Monuments Department of the Office of Works.

Irish Free State.—Broadcasting Station for Dublin.—According to a notice issued by the Secretary of the General Post Office, Dublin, the Irish Postmaster-General is inviting applications from Irish persons, or firms, who are prepared, under licence from him, to undertake the establishment and operation of a radio-broadcasting station in Dublin. Such applications will be received up to the 20th inst.

Radio-Broadcasting.—Time Signals.—Every listener-in may rest assured that the time signals sent out from the British Broadcasting Co.'s new stations will be of the most accurate nature. For some time past the Birmingham station has been equipped with a system of "Pulsynetic" electric impulse clocks made and supplied by Messrs. Gent & Co., Ltd. Owing to the success of this system, it has been decided that the new stations at Aberdeen, Bournemouth, and Manchester shall be fitted with Pulsynetic electric clocks for time-signal announcements. Each installation will have a master clock, from which the time signal is given, and from the beat of whose pendulum the announcer counts the seconds. In addition, three secondary dials driven by the master clock indicate accurate and uniform time in the other important rooms in the station.

Manchester Station.—On Friday last, the British Broadcasting Co. took over premises in Dickinson Street, Manchester, whence in future its broadcast programmes will be transmitted. The first concert to be sent out from the new premises was on Friday afternoon.

South Africa.—Radio-Broadcasting.—It is stated that the Cape Town City Council is considering a scheme of municipal broadcasting, and that in this connection Sir David Graff has offered to erect at his own expense a complete six-kilowatt Marconi broadcasting station—*The Times.*

Underground Radio Reception.—Mine Experiments.—Experiments with S.S. 2-valve sets manufactured by Messrs. A. Franks, Ltd., and a 4-valve experimental set made by Messrs. L. McMichael, Ltd., have been carried out at one of the Wigan Coal and Iron Co.'s collieries. The instruments were fixed in a pit cage, and the programme of the Manchester Broadcasting station was heard quite clearly at the surface of the mine. At a depth of 120 ft. there was practically nothing to be heard on the instruments; at 240 ft. reception began to improve and continued to do so until the full depth of 792 ft. was reached. No interference was experienced from the alternating-current cables (2,200 volts) which run the length of the pit shaft.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Argentina.—Buenos Aires.—September 10th-October 3rd. State Railways. Stores (including telegraph and telephone and electrical materials) for 12 months.*

Australia. — Melbourne. — Commonwealth Government. Various dates. Cable distributing terminals; bells, cords, and plugs; switchboards; telephone parts; motor-generator sets; and submarine cables. (August 3rd.)

August 23rd. Protective apparatus. (See this issue.)

Sydney.—September 19th. New South Wales Government Railways and Tramways. One 7,500-kW frequency changer for White Bay power house. Chief electrical engineer, 61, Hunter Street, Sydney.*

August 30th. Postmaster-General's Department. Motor generators.*

September 24th. Municipal Council. Consumers' meters.*

Bowen (Queensland).—September 3rd. Municipal Council. Plant and works in connection with the electricity supply undertaking: Boiler plant, steam-driven electricity generating plant, main switchboard. Messrs. A. E. Harding Frew and T. W. Bridger, consulting engineers, Telegraph Chambers, Queen Street, Brisbane.

Brisbane.—September 19th. Postmaster-General's Department. Telephone apparatus and parts.*

Perth (W.A.).—October 10th. Postmaster-General's Department. Battery plates and wood separators, &c.*

Belfast.—August 13th. Electricity Department. Transformer oil. (August 3rd.)

Belgium. — August 17th. The Belgian Ministry of National Defence, 10, Rue du Méridien, Brussels. 4,000 rolls of insulating tape for the use of the Telegraphists' Battalion.

Bradford.—August 16th. Corporation. Supply and erection of two 1,000-kW rotary or motor converters. (July 27th.)

September 6th. Electricity Department. One surface condensing plant, with auxiliaries. (See this issue.)

Edinburgh. — September 3rd. Electricity Department. Supply and erection of a 33,000-V overhead main transmission line. (July 27th.)

Esthonia.—September 1st. Reval Tramways Administration. Tramway standards.*

Fleetwood. — August 27th. Electricity Department. 1,050 yd. cable. (See this issue.)

Grimsby.—September 4th. Electricity Department. One 3,000-kW turbo-alternator, with condenser, pipework, motor-driven auxiliaries, &c. (July 27th.)

Hazel Grove and Bramhall.—August 20th. Urban District Council. Three-phase, four-core, lead-covered and armoured cable; l.p. sub-station switchgear; and a.c. electricity meters. (July 27th.)

Hong-Kong.—The Government of Hong-Kong invites tenders for a concession to run an electric tramway service on certain roads in the Kowloon Peninsula. (August 3rd.)

Irish Free State.—Dublin.—August 13th. Corporation. Engine and turbine oils, &c., for electricity department. Town Clerk, Dublin.

Ennis (Co. Clare).—August 14th. Committee, Clare Mental Hospital. Electric lighting plant, as detailed in our last issue.

Liverpool.—August 15th. Board of Guardians. Eleven all-metal food trolleys and 20 electrically-heated warming cupboards for West Derby Board of Guardians. Clerk to Guardians, Broughton Terrace, Liverpool.

London. — London County Council. — September 17th. Machine tools for the Council's tramway central repair depôt. Manager, L.C.C. Tramways, Victoria Embankment, W.C.

H.M. Office of Works. August 21st. Electrical wiring installation at Somerset House, Strand, W.C. (See this issue.)

St. Pancras.—August 15th. Electricity Committee. One 5,000-kW steam turbine with 3-phase alternator and condensing plant, &c. (August 3rd.)

Lytham St. Anne's.—August 25th. Electricity Department. E.h.p. cable. (See this issue.)

Macao.—September 15th. The Macao Government invites tenders for the construction and exploitation of a wireless station, electric power machinery, and electric conveyances.

Manchester. — August 15th. Board of Guardians. Supplying and fixing electric service mains to nurses' home at Booth Hall Infirmary, Charlestown Road, Blackley. Mr. H. Hargreaves, superintendent of works, Union Offices, All Saints', Manchester.

August 21st. Electricity Committee. Constructional steelwork required in erection of new sub-station, Gorton. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

September 15th. Waterworks Committee. One set electrically-driven h.p. centrifugal pumps. (See this issue.)

Newcastle-under-Lyme.—August 27th. Electricity Department. 3,000 yd. 3-core e.h.p. armoured cable. (See this issue.)

New Zealand. — Wellington. — October 22nd. Public Works Department. One 400-kVA, 3-phase transformer, complete.*

Norwich. — September 11th. Electricity Department. Plant in connection with Thorpe power station :—Two 5,000-kW, 3-phase turbo-alternators, with exciters, condensers, and auxiliary plant; three 40,000-lb. per hour water-tube boilers, with superheaters, mechanical stokers, forced-draught fans, &c.; one pair of motor-driven 12-kW boosters; one 550 amp.-hour battery of accumulators, &c.; one 50-ton overhead travelling electric crane. (See this issue.)

Pontypridd. — August 27th. Electricity Department. 2,700 yd. 3-core l.p. cable, 2,000 yd. l.p. electric lighting overhead lines. (See this issue.)

Selby.—August 18th. Electric lighting installation at the Wesleyan Chapel. Mr. W. T. Blackburn, Brayton Road, Selby.

Singapore.—September 7th. Municipal Commissioners. 5,000-kW turbo-alternators and condensing plant; water-tube boilers, draught plants, and steel chimney. (See this issue.)

South Africa.—Johannesburg.—September 24th. South Africa Railways Tender Board. Incandescent lamps.*

Warrington.—August 11th. Supply of three electrically-driven centrifugal pumps for Waterworks Department. Deposit £1 1s. (returnable). Particulars from Mr. J. Gray, waterworks engineer, Municipal Offices, Warrington.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Aberayron.—Accepted:—
Installing electric lighting, Tabernacle Church (£107).—E. Richards.

Belgium.—Ten Belgian concerns competed for the order for 100 transformers, tenders for which were recently invited by the Provincial Government authorities at Hasselt; the lowest offer was that of the Société Belge Gardy, of Uccle.

Blackpool.—Tramways Committee. Accepted:—
Eight sets of complete tramcar electrical equipment.—British Thomson-Houston Co., Ltd.

Bolton.—Tramways Committee. Accepted:—
Special track work required in relaying the Town Circle tramway.—Hadfields, Ltd.

Public Health Committee. Accepted :—
Electric lighting and power installations at the Moss Street baths.—Bolton Corporation Electric Fittings Department.

Cornforth (Co. Durham).—The Parish Council has accepted the tender of Deveraux, Moody & Co., for overhauling electric lamps at Coxhoe, and for fixing new wires and tubing, &c.

Dartford.—Urban Council. Accepted:—
Switchgear and cables (£729); cables for the supply to the West main sewerage works (£2,306); switchboard control panel (£312); truck-type switchgear (£184).—Johnson & Phillips, Ltd.
Pipe work (£227).—Seagers, Ltd.
Transformer, &c. (£1,274); gallery and air ducts (£280).—Brush Electrical Engineering Co., Ltd.

Leicester.—Electricity Committee. Recommended:—
10,000-kW turbo-alternator (£31,835).—English Electric Co., Ltd.
Condensing plant (£9,578).—English Electric Co., Ltd.
500-kW auxiliary turbo-generator (£4,800).—W. H. Allen, Son & Co., Ltd.

At a meeting of the City Council, on July 31st, objection was taken to so much of the new electrical work going to the English Electric Co., and to the fact that the lowest tenders had not been accepted. Alderman Flint, chairman of the Committee, said regard had to be paid to coal consumption, &c., and, so far as the Committee were advised by their experts, the English Electric Co.'s machinery was the best suited to their requirements. It was not always the wisest policy to accept the lowest tender when electrical equipment was being purchased.

Leatherhead.—Urban Council. Accepted:—
Installing electric lighting at Surrey House.—J. D. Sandell.

Luton (Beds.).—Management Committee, Bute Hospital. Accepted :—
Installing electric lighting.—Mr. Shoolbred.

Manchester.—Tramways Committee. Accepted:—
Special track work (£14,027).—United States Steel Products Co. The lowest English tender was £15,465. The T.C. has confirmed the Tramways Committee's recommendation.

Penkridge. — Staffordshire Education Committee. Accepted :—
Installation of electric lighting at the County Farm Institute: Electric light installation, with underground main (£1,828).—Smith & Bellhouse.
30-b.h.p. crude oil engine, with belt-driven dynamo (£365).—Tangyes, Ltd.
Builder's work, including adaptation of premises as power station (£136).—Mason & Son.

Reigate.—Town Council. Accepted:—
Transformer kiosk at Meadvale (£139).—Callender's Cable & Construction Co., Ltd.

Staffordshire.—The Staffordshire, &c., Committee for Tuberculosis. Accepted :—
Electrical work at Groundslow Sanatorium :—
Installing electric light (£575).—Smith & Bellhouse.
Engine and dynamo (£531).—Ruston & Hornsby, Ltd.

Tiffield.—Northamptonshire Training School. Accepted:—
Installation of electric lighting plant and wiring.—Lowke & Sons, Ltd.

Worthing.—Electricity Committee. Accepted:—
750-kW Diesel engine, with dynamo (£11,365).—English Electric Co., Ltd.

NOTES.

An Association of Exhibitors.—As a result of the meeting held in London in June it was unanimously agreed to form an "Association of British Exhibitors." A provisional committee was elected comprising representatives of important exhibitors in the United Kingdom. Articles of association are now being drawn up. The committee is anxious to put into the hands of all exhibitors full particulars of the aims and objects of the Association. The provisional secretary is Mr. E. C. Balmforth, Association of British Exhibitors, 69, Victoria Street, London, S.W.1.

Electric Postal Meter.—An electrically-driven postage meter that will seal and stamp an envelope, marking the requisite postage all in one operation, has been approved by the Postmaster-General in Ottawa. Several of the new meters are already in operation in Ottawa and Toronto, and they are said to be assisting immeasurably in the dispatch of mails. With their general use it is expected that a saving of many thousands of dollars will be effected in the Post Office Department in the manufacture and despatching of postage stamps. Each machine is furnished with a permit number, and is under the direct control of the department.

South African Electricity Commission.—His Majesty's Senior Trade Commissioner in South Africa (Mr. W. G. Wickham), has forwarded to the Department of Overseas Trade a memorandum concerning the formation and functions of the Electricity Supply Commission.

Several electrical schemes are already engaging the Commission's consideration. An investigation in terms of the Electricity Act is proceeding with regard to the electrical power requirements and potentialities of the Witbank area, which is the centre of the Transvaal Goldfields and an eminently suitable area for the generation and distribution of electricity on a large scale. A new power station is required at Durban for municipal purposes. The Commission has commenced negotiations with the Durban Municipality and has offered to build a large station there to provide for municipal, railway, and harbour requirements in the Durban area, the electrification of the main line between Durban and Pietermaritzburg, and industrial and other purposes along the railway route.

The Railway Administration has under construction at Colenso, in connection with the electrification of the railway line between Pietermaritzburg and Glencoe Junction, a station which will contain five turbo-alternator sets each having a normal capacity of 12,000 kW. The intention is that the Commission shall take over the station and the transmission lines in connection therewith, and in the event of the Durban power station being built by the Commission the stations at Durban and Colenso will be linked up and worked in unison.

Appointments Vacant.—Superintendent of meter department, for the Newcastle and District Electric Lighting Co., Ltd.; showroom assistant, for the City of Birmingham electricity department. (See our advertisement pages to-day.)

Electric Vehicles in the U.S. Post Office.—Continued consideration over a period of years has resulted in the purchase of sixteen electric trucks by the United States Post Office authorities. These vehicles include four trucks manufactured by each of four companies—the Commercial Truck Co., the Auto-car Sales & Service Co., the Ward Motor Vehicle Co., and the Walker Vehicle Co. The trucks will be used in New York, Boston, Chicago, Philadelphia, Detroit, St. Louis, Washington and other cities. According to the *Electrical World*, careful records of operating costs, as compared with gasoline operation, will be kept and the result will undoubtedly influence future purchases of electric trucks for Post Office use. It is interesting to note that a few years ago W. G. Richards estimated that there would be an annual saving of $200,000 in New York City alone, and more than a million dollars the country over, if gasoline trucks were replaced by electrics for Post Office service.

Radio Notes.—The following statement was issued by the secretary of the Broadcasting Committee on the 7th inst.:—

It had been anticipated that the Broadcasting Committee would be in a position to present its report to the Postmaster-General early in August, but it has been found necessary to make further inquiries into certain financial questions affecting the broadcasting problem, and the Committee will, in consequence, be unable to make its report as early as had been expected.—*The Times.*

Melville Thomas, a chemist, was at Neath, Glamorgan, on August 7th, summoned for obstruction by causing a crowd to assemble to hear a wireless demonstration in his shop. As it was the first prosecution of its kind locally the case was dismissed on payment of costs, says the *Daily Mail.*

According to the *Birmingham Post*, the aerial which has just been completed at the new Birmingham station of the British Broadcasting Co. in Summer Lane is said to be the largest of its kind in the kingdom. It is 210 ft. in height, and the distance between the insulators, which are fixed on two of the smoke stacks of the Summer Lane generating station, is over 100 ft. The aerial is of the T-cage type, sometimes described as the "sausage" pattern. It consists of six phosphor bronze wires, each of seven strands of 20 gauge wire. The hoops, which are fixed inside the wires, are four feet in diameter. It is hoped to open the station on Saturday.

Rome's Tube Railway.—Work will soon be begun on Rome's first "tube" if plans now before Senator Cremonesi, the Royal Commissioner for the Municipality of Rome, are approved. The plans have been submitted by a syndicate in which much American capital is interested, and provide for a circular subway linking up Rome's suburbs. Many previous projects for tubes in Rome have been abandoned owing to the friable nature of the subsoil. It was feared that the foundations of the Roman palaces and other architectural treasures might be injured.—*Daily Mail.*

New B.C. Railway Plant.—The British Columbia Electric Railway Co. has let the contract for one 6,000-kVA synchronous condenser, with a 1,000-kW d.c. generator attached and one 3,750-kVA synchronous condenser, also with a 1,000-kW generator attached, to the Canadian General Electric Co. This apparatus, with the necessary switchboard devices, will cost $157,000. The former will be placed in the Main Street sub-station, and the latter in the Burnaby sub-station. Correction of power factor is the purpose of the new equipment. This company plans to erect, at an early date, a 6,000-kVA sub-station at Port Moody, to replace small transformer stations at Port Moody and Coquitlam, which were destroyed by fire. Step-down transformers, from 34,600 to 12,000 V, will be installed. Current will be delivered direct from the Lake Buntzen hydro-electric plants. The cost will be $55,000. A new bank of three 500-kVA transformers will be installed in the company's Cloverdale sub-station, replacing a similar number of an old air-blast type. This equipment will cost $14,000.—*Journal of Electricity.*

Fatality.—While working inside a boiler at Pleasley Vale, Notts, recently, Charles Keeling, of Birkenhead, employed by an electric welding company, received a fatal electric shock.

The Care of Instruments.—The June *Bulletin* of the Hydro-Electric Power Commission of Ontario reproduced a number of "Instrument Dont's" culled from a pamphlet issued by an instrument manufacturing company. The following were among them:—

"Don't mount instruments 8 ft. above the floor line and expect to be able to read them unless you are prepared to furnish switchboard attendants 8 ft. high. Eight-foot attendants are scarce and expensive.

"Don't place an instrument on top of an excited dynamo or motor. You will find a strong attachment between them and the instrument will resent the rupture of relations and become erratic in its performance. Instruments are very human in this respect.

"Don't be afraid to tell an instrument maker what you want to measure and how you would like to do it. His suggestions may save you money, and will certainly lead to a better mutual understanding.

"Don't set up a switchboard so that it can vibrate continuously and expect the instruments to stand it. Vibration causes friction, friction causes heat, and heat causes a disinclination for steady, accurate work.

"Don't ship a switchboard with instruments attached. If you have ever tried travelling in a freight car on a marble couch you will understand why. A small amount of paper and 'excelsior' with a berth in an express car saves most of the tiring effects of travel.

"Don't make a loop of your bus bars or risers and then mount an instrument within that loop. The field set up by such a loop worries an instument and disturbs its natural truthfulness.

"Don't blame the instruments because your plant does not work satisfactorily. The instruments are intended to indicate trouble, not to remove it. The moral is: Look for the trouble and the instruments will tell you when you have found and remedied it."

Styrian Water Power.—Whereas in the Austria of old power was produced almost exclusively from coal, Austria is now forced to economise her insignificant coal resources to the utmost extent. The production of power for the future will have to be done on a hydro-electric basis. The utilisation of this power has already commenced, but lack of capital has caused wholly inadequate progress to be made. Austria has about 3,000,000 h.p. of workable water powers. The complete electrification of all industries and of the railways would require altogether about 1,500,000 h.p. The cost of this development, including the long-distance network and sub-stations, would total about 2,000,000,000 gold crowns, and the development would be extended over a period of twenty or thirty years.

As pointed out in a report by Richard Hofbauer, chief engineer of the Styrian Water Power and Electricity Co., Ltd., the foundation for organising production is to be found in the electrical companies already existing, which, however, form only an insignificant part of what is actually required by the nation as a whole. The nation-wide scheme advocated by the Styrian company is the first attempt at a development of the water-power resources of Austria on a large scale. A plan has been drawn up, showing the locations selected for the power plant and describing the long-distance and distributing networks necessary to meet the existing load requirements. The programme is to extend over fifteen years, in which period all the plant required for the actual energy supply, inclusive of long-distance lines and transformer stations, will be constructed.

The maximum load of the future Styrian long-distance network, inclusive of overload, is estimated at about 265,000 kW; however, consideration has been taken of the probable development of the iron industry, which is one of the most prominent industries of Austria.

The scheme as proposed has been considerably accelerated by the course of the Government in granting concessions for water powers. In order that the electrical energy produced may be distributed to consumers uniformly in accordance with their requirements, the country has been divided into five centres of supply. The organisation of the whole enterprise, comprising all the power stations, long-distance lines and transformer stations, is intended to be carried through by the Styrian Water Power and Electricity Co. interests. This parent company will control the generating plant and transmission systems, but the distribution of electrical energy from the main transformer stations will be confided to sub-companies to be formed in the different centres of supply. A syndicate has been formed to carry out the financial management of the enterprise, all the large Austrian banks forming a part of it.

New 410,000-kVA Station.—The largest initial generating capacity so far incorporated in any station will be installed in the new Kearny station of the Public Service Electric Power Co., of New Jersey, U.S.A., the construction of which will be started shortly and is expected to be completed early in 1925. This station will have an initial installed generator rating of 205,000 kVA at 80 per cent. power factor, and will probably have an ultimate rating of 410,000 kVA.

Five turbo-generators will be installed initially, three of which will be 39,200-kVA General Electric and two will be 43,750-kVA Westinghouse units. They will be designed for a throttle pressure of 325 lb. and 271 deg. superheat, making a total steam temperature of 700 deg. F. New features will be incorporated in the General Electric units which cannot be announced at this time. The chief feature in the Westinghouse units will be the multiple exhaust. Electrical auxiliaries will be used almost without exception. No house turbines will be installed, the power for the auxiliaries is to come directly from the main generators. The only steam units will be just enough turbine-driven boiler-feed pumps to keep the boilers on the line without load in case all service to the electric auxiliaries is interrupted. Superstokers about 17 ft. long, consisting of sixteen retorts, will be employed with Babcock and Wilcox boilers rated at 2,360 h.p. (based on the heating surface). No economisers will be used. The boiler-feed water will be heated entirely by bleeding from three or four stages of the turbines.—*Electrical World.*

INSTITUTION NOTES.

Australian Radio Relay League.—A body to be known as the Australasian Radio Relay League has been formed in Sydney with the object of organising a system whereby amateur messages may be relayed throughout Australia. Operations will be conducted under the auspices of the Australian Wireless Institute.

Institute of Metals.—The autumn meeting of the Institute will be held at Manchester from September 10th to 13th. An attractive programme has been arranged, which includes the reading and discussion of papers, visits to local electrical and other works, the formal opening of the new building of the Department of Metallurgy of the Manchester University, a smoking concert, an excursion to Chester, &c.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. W. A. GILLOTT, A.M.I.E.E., informs us that his address is now: Burnham House, Somerset Road, New Barnet, Herts.

A London paper reports that for "faithful service during a period of great difficulty," the Finchley Council has voted the electrical engineer a bonus of 200 guineas.

Mr. C. W. EMANUEL has resigned his position of mains assistant with the Hendon Electric Supply Co., Ltd., in order to take up a similar position with the Watford Corporation Electricity Department.

The Southport Electricity Committee last week decided to recommend that the salary of the engineer, Mr. MOXON, be advanced by £200 per annum to £1,000.

Mr. H. F. D. JACOB, executive engineer, electrical division of the P.W.D., Bengal, India, will be in London during September, and may be seen at the Engineers' Club by appointment.

Mr. A. H. JACKSON has resigned his position as traction representative to the English Electric Co., Ltd., on being appointed sales manager of the Electric Traction Department of the General Electric Co., Ltd., Magnet House. Mr. Jackson, who was formerly traction representative of the British Westinghouse Electric and Manufacturing Co., and who received his technical training at the City and Guilds of London Technical College, Finsbury, under the late Prof. Silvanus P. Thompson, has had a wide and specialised experience in all branches of electric traction work, having been identified during the last 22 years with the Brush Electrical Engineering Co., Ltd., the London Underground Railways, the British Electric Traction Co., Ltd., the London County Council Tramways, the British Westinghouse Electric and Manufacturing Co., Ltd. (now Metropolitan-Vickers Electrical Co., Ltd.), and the English Electric Co., Ltd. All communications for him should be addressed in future to Magnet House, Kingsway, London, W.C.2.

Mr. W. C. L. EGLIN, vice-president and chief engineer of the Philadelphia Electric Co., together with Messrs. GEORGE P. ROUX and E. HOPPING, of the same company, are at present on this side of the Atlantic, with the object of looking into general central station practice in Great Britain and the Continent of Europe.

We regret to have to record that Dr. PERCY LONGMUIR, the Director of Research to the British Cast-Iron Research Association, has had to resign his post owing to a serious breakdown in health. Dr. Longmuir has now gone away to the East Coast for a rest, but will continue in office until next November. The Council is taking steps to appoint at once a successor to Dr. Longmuir, so that the research work now being carried out can be continued without a break. Before Dr. Longmuir finally retires he proposes to issue the *Bulletins* detailing the research work he has carried out.

Obituary.—DR. LOUIS BELL.—We regret to record the death, which occurred in June at the age of 58 years, of Dr. Louis Bell, the well-known American authority on power transmission and electrical illumination. Dr. Bell in 1888 joined the faculty of Purdue University at Lafayette, Ind., as professor of physics and applied engineering. Here he organised the department of electrical engineering. In 1890, after a year of engineering practice in Chicago, he became editor of the *Electrical World*, retaining that post until 1892, when he resigned to become chief engineer of the newly-organised power transmission department of the General Electric Company. The *Electrical World* records that his pioneer work in this connection was of the greatest importance in placing this branch of the art on a commercial and an engineering basis. As engineer for the General Electric Co., he designed and installed at Redlands, Cal., in 1893 the first three-phase transmission plant for general service. He also installed at Taftville, Conn., the first polyphase transmission plant for cotton-mill drive and for electric railway operation. In 1894 he took charge of the General Electric power work in the Chicago territory, removing to Boston in the following year to establish his own office. From 1895 to 1905 he lectured on power transmission at the Massachusetts Institute of Technology. He was the author of many books on his subject, some of which became standard treatises.

Dr. Bell, says our New York contemporary, took out 40 patents relating to power transmission and optical apparatus. He was a past-president of the Illuminating Engineering Society, a member of the American Institute of Electrical Engineers, of which he was a manager in 1891-94; a member of the International Electrotechnical Commission and the International Illumination Commission, and a Fellow of the American Academy of Arts and Sciences. He received from British illuminating engineers the compliment of being made a vice-president of the Illuminating Engineering Society of London. He was secretary of the power transmission section of the International Electrical Congress held at St. Louis in 1904, and for six years (1895-1900) was chairman of the Incandescent Lamp Committee of the National Electric Light Association. In 1908 he undertook a roving commission in Europe for the Edison Electric Illuminating Co., of Boston, studying the developments in lighting in many cities.

In the world war he was a member of the Advisory Committee of the Council of National Defence, and, in collaboration with Norman Marshall, of Waltham, Mass., invented a system of signalling by ultra-violet rays which enabled dots and dashes invisible to the enemy to be transmitted, but with accurate reception for several miles by forces provided with the proper apparatus. This important contribution to the art of war was delayed in reaching the front by causes beyond the control of the inventors, although it is understood that it was successfully tested in the zone of advance and would have found widespread use had hostilities continued.

Mr. C. E. MUSGRAVE.—The death has occurred of Mr. Charles E. Musgrave, secretary of the London Chamber of Commerce (Inc.). Mr. Musgrave, who was 62 years of age, succeeded Mr. Kenric B. Murray in the secretaryship on the latter's retirement some 14 years ago, but he had been assistant secretary for many years previously, having left City journalism to assist Mr. Murray. He was well-known to commercial communities in London and many other places throughout the world.

MAJOR W. TOZER.—Major William Tozer, a director of Steel, Peech & Tozer and the United Steel Companies, passed away on August 2nd at his Sheffield residence.

DR. W. v. OECHELHAEUSER.—*Nature* records the death at Dessau in May last, at the age of 73 years, of Dr. W. von Oechelhaeuser, a former director-general of the German Continental Gas Co. He constructed the first gas engine on the Oechelhaeuser system, by which it became possible to use the gas from a blast furnace directly for power production. He is credited with having raised the social status of the engineer in Germany.

Will.—The late Mr. J. C. SMITH, accountant of the Anglo-American Telegraph Co., left £5,512 gross and £5,037 net personalty.

NEW COMPANIES REGISTERED.

Trust Electrical Accessories Manufacturing Co., Ltd. (191,637).—Private company. Registered July 30th. Capital, £500 in £1 shares. To carry on the business of manufacturers, importers, and exporters of, and dealers in electrical, gas, oil, lighting, heating, and power goods and accessories, &c. The first directors are:—John Berg, 196, Green Lanes, Stoke Newington, N.4; Mrs. Ada Berg, 196, Green Lanes, Stoke Newington, N.4. Secretary: J. Bloom. Registered office: 169, City Road, E.C.

Traggoh Lamp Co., Ltd. (191,636).—Private company. Registered July 30th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of, and dealers in all kinds of dynamos, electrical motors, batteries, generators of electricity, and electric lighting and starting sets and apparatus for motor-cars, automobiles, lorries, and charabancs, &c. The subscribers (each with one share) are:—S. Hoggart, 18, Harehills Terrace, Leeds, engineer; C. Thornhill, 28, Broughton Avenue, Leeds, clerk. S. Hoggart is the first director. Registered office: 14, Butts Court, Leeds.

Eclat Electric Manufacturing Co., Ltd. (191,583).—Private company. Registered July 27th. Capital, £500 in £1 shares. To acquire the businesses of and selling electric lamps now or lately carried on by E. R. Grote as "The Spencer Lamp Works" and "Standard Lamp Works" at Spencer Hill Road, Wimbledon, and 8, St. Stephen's House, Victoria Embankment, S.W. The permanent directors are:—J. M. Longe (chairman), Greenford Lodge, Greenford, Middlesex, gent.; P. V. Cestelli Evans, "Carn Dochan," Elthorne Heights, W.7, engineer. Qualification, 1 share. Remuneration, £50 each per annum, free of tax. Solicitors: Brun Millar & Co., 28a, Basinghall Street, E.C.2.

Henry Joseph & Co., Ltd. (191,588).—Private company. Registered July 27th. Capital, £4,000 in 3,800 6 per cent. cumulative preference shares of £1 each and 2,000 "A" ordinary and 2,000 "B" ordinary shares of 1s. each. To acquire from H. Joseph, S. J. Wolfski, and W. J. Salaman the business of general merchants, importers, exporters, and agents carried on by them at 96, Victoria Street, S.W., as "Henry Joseph & Co.," and to carry on the business of dealers in electrical appliances and accessories, shippers, forwarding agents, underwriters, gold and silversmiths, jewellers, gem merchants, electroplaters, &c. The first directors are:—W. J. Salaman (permanent), 96, Victoria Street, Westminster, S.W., merchant; H. Joseph, 43b, Clifton Gardens, Maida Vale, W.9, electrical engineer; S. J. Wolfski, no address given. Qualification, 10 preference or 200 "A" or "B" ordinary shares. Remuneration as fixed by the company. Registered office: 96, Victoria Street, Westminster, S.W.

Webber & Meecham, Ltd. (191,640).—Private company. Registered July 30th. Capital, £500 in £1 shares. To acquire the business carried on by P. H. Webber and A. B. Meecham at 62, Wardour Street, W., as "Webber & Meecham," and to carry on the business of kinematograph, electrical, automobile, radio, constructional, and general engineers, &c. The first directors are:—P. H. Webber, "The Willows," Nazeing Road, Broxbourne, Herts. (chairman); A. B. Meecham, 44, Larkhall Rise, Clapham, S.W.4. Qualification (except first directors), £500. Registered office: 62, Wardour Street, W.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Edmundson's Electricity Corporation, Ltd.—Satisfaction in full on July 20th, 1923, of mortgage or charge dated May 6th, 1914, securing £18,000.

Radio Appliances, Ltd.—E. J. Bell, of 17, Queen Victoria Street, E.C., was appointed receiver and manager on July 20th under powers contained in debentures dated April 9th, 1923.

Hull Road Motor and Electrical Engineering Co., Ltd.—Satisfaction in full on July 7th, 1923, of debenture dated December 31st, 1922, securing £1,500.

Mortgage debenture dated July 9th, 1923, to secure £3,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Willesden Electric, Ltd.—W. R. Clemens, of Alderman's House, Alderman's Walk, Bishopsgate, E.C., was appointed receiver and manager on July 23rd, 1923, under powers contained in debentures dated November 18th, 1922.

CITY NOTES.

Enfield Cable Works, Ltd.

In the directors' report for the year ended June 30th, 1923, it is stated that the name of the company has been changed by the omission of the word "Ediswan." The Edison Swan Electric Co., Ltd., is no longer represented on the board, and has contracted to sell its shareholding. On June 16th, 1923, the public were invited to subscribe for 200,000 7½ per cent. cumulative preference shares. The whole issue was underwritten by Messrs. Seymour, Pierce & Co. on a 2½ per cent. underwriting and ½ per cent. overriding commission. The profit for the year ended June 30th, 1923, before charging directors' fees and commissions, interest on bank loan, and corporation profits tax, is £43,646, plus the balance brought in from the previous year, amounting to £4,224, making altogether £47,870. After paying directors' fees and commissions, interest on bank loan, and corporation profits tax, there remains £34,148. It is proposed to pay a dividend of 10 per cent. on the ordinary shares, absorbing £20,206, and to write £2,999 off preliminary expenses. This will leave £10,943 to carry forward. A considerably increased business has been done, and the prospects for the current year promise still further expansion both in volume and in rate of profit. Meeting: August 16th.

Tyneside Tramways and Tramroads Co.

For the half-year ended June 30th the surplus of receipts over expenses was £3,128, plus £175 brought forward. Interest on mortgages, loans, &c., amounted to £1,914; preference dividend at the rate of 5 per cent. per annum (less tax), £601; renewals, depreciation, &c., £500; carried forward, £287. The decreased profit is entirely consequent upon the reduction in traffic receipts, amounting to £1,712, against which the reduction in running expenses was £762. The fall in revenue is due to the smaller traffic, caused by labour troubles and severe depression in trade.

French Companies.

The *Ateliers de Constructions Electriques de Delle* reports net profits of 937,000 fr. for 1922 and a dividend at the rate of 60 fr. per share.

The *Compagnie Continentale Edison* has declared a dividend at the rate of 25 fr. per share out of net profits of 775,000 fr. in 1922.

The *Société des Accumulateurs Electriques* (Dinin) of Nanterre, records profits of 1,160,000 fr. for the year ended June 30th, 1923, permitting of the payment of a dividend at the rate of 6 per cent.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 4¼ per cent. per annum, less income tax, for the half-year ended June 30th; also an interim dividend on the ordinary shares of 1s. per share, less income tax.

National Gas Engine Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less income tax, on preference shares for the six months ended June 30th, 1923. Owing to the depression in trade, the directors do not consider it advisable to pay a dividend on the ordinary shares for the half-year's working.

Consolidated Electrical Co., Ltd.—The report for 1922-23 shows a surplus of £850 on an income of £3,124, to which is added £1,238 brought forward. Owing to the serious decline in the income from investments, the directors have decided not to pay the preference dividend for the year. The disproportion between receipts and expenses has caused the directors to question the advisability of continuing the company, and at the meeting on August 14th the views of the shareholders will be ascertained.

Victoria Falls and Transvaal Power Co., Ltd.—The net earnings of the company, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended March 31st, 1923, amounted to £231,116, before providing for British and South African taxation.

Stock Exchange Notice.—The undermentioned has been ordered to be officially quoted:—

North Metropolitan Electric Power Supply.—20,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 320,001 to 340,000).

STOCKS AND SHARES.

TUESDAY EVENING.

To write a financial article this week without mentioning the words "holiday influences" would be to run counter to every canon of convention. Moreover, these influences are very much emphasised at the present time owing to the foreign political chaos, which would impose restriction upon enterprise even if the summer holidays were not in full swing. Stock Exchange markets are languid, and to a large extent, neglected. A fresh outbreak of weakness in cable securities is something of a feature.

Eastern Telegraph ordinary has dropped 13¼ points to 165. The quotation is considerably widened in the Stock Exchange lists. Instead of there being a margin of three or four points between the nominal buying and selling quotations, there is now no less than 10—clear indication of a nervous and apprehensive market. The cable companies' proprietors are afraid of wireless; that is the position in a nutshell. Similar outbreaks of anxiety have occurred many times in the past. The present weakness is a phase. That the cable companies are fully alive to the position, Sir John Denison-Pender's recent speech at the Eastern Telegraph meeting demonstrated. This company has the right for apply for a licence in order to erect a station in the Imperial wireless chain. But the nervousness of shareholders takes no heed of this, and all the units in the Eastern group are weak.

Marconis, meanwhile, are a duller market, which seems inappropriate in the circumstances. The parent company's shares followed up their last week's advance with further improvement, but slipped back again to 2 5/16. Canadians are a little better. Lively movements in Radios led to a drop in the common to 13s., although the preferred kept fairly firm at 14s. 3d. The selling of the former shares is said to emanate from America. The Marconi report will be delayed, but the directors announce that the company's profits for last year are not less than those of the preceding twelve months.

Charing Cross, West End and City Electricity Supply has declared an interim dividend of 5s. on the ordinary shares of the West End company. On the Charing Cross and City ordinary, no dividend has been paid for over ten years. The Westminster Electric's interim dividend is 4s. 6d. per share. Both of these are the same as those of a year ago. With the interim dividend at the rate of 7 per cent. tax free, the Electrical Distribution of Yorkshire announces that a new issue of capital will be offered to the shareholders, probably in the early part of next year. The Yorkshire Electric Power Company's interim dividend, at the rate of 6 per cent. is also unchanged.

Clyde Valley Electrical Power Company appears to be doing well, for the interim dividend on the ordinary is to be 3 per cent. actual, an increase of one-half per cent. The market in all the established electricity supply and power issues is steady. County of London new ordinary, now fully paid, are better at 37s. 6d.; the old have strengthened to 39s. City "Lights," St. James' & Pall Mall, and Metropolitan ordinary are all better on the week.

Electrical railway stocks have given way. There are falls in Metropolitans and Districts, as well as in both classes of shares of the Underground Electric railways. The City and South London extension has duly received the consent of the House of Lords, but this did not affect the market one way or the other. British Electric Tractions are steady, and other traction stocks somewhat irregular. Anglo-Argentine Tramways debenture is 2 lower at 72½. The first preference weakened to 3 1/16. Mexican Utilities remain flat. The reason for the perplexing weakness which has characterised this market for nearly a month is now explained by information with regard to the Mexican Government's wish to tax the Mexico Tramways Company 10 per cent. of its gross profits. This does not seem to have been generally known over here until lately, and the selling which started in Mexico Tramway issues caused sympathetic depression in Mexican Light & Power stocks. Further falls occurred this week. It would be useful, moreover, if proprietors were furnished with a little up-to-date information, for they have not much recent news to go upon, and, although it is understood that the companies are doing well, some official information might be reassuring; it would certainly be welcome.

Henley's have declared their usual interim dividend of 1s. a share, but the price of the ordinary is 1/16 down at 2 5/16. Babcock & Wilcox shed 7½d. Beyond these movements, the manufacturing market is very quiet. Of the new issues, Lima Light & Power debenture has weakened to 1¾ discount, while the Tokio Sixes, after being down to 10s. discount, are a shade better at their issue price of 94. Enfield (Ediswan) preference are slightly higher on the issue of a satisfactory report, showing an increased dividend on the ordinary shares.

Rubber shares strengthened in consequence of a recovery in the price of the raw material to 1s. 3d. per lb. The general tendency of iron and steel shares is dull, though the beginning of the week, following upon August Bank Holiday, found a little inquiry from those who wanted to pick up stock if this was being offered cheaply.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom. £	Dividend. 1921.	Dividend. 1922.	Price Aug. 7. 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	12	1½	—	£6 2 6
Charing Cross Ordinary ...	5	9	14	11½	—	6 4 5
do. do. do. 4½ Pref.	5	4½	4½	4¾	—	5 2 10
Chelsea	1	6	10	34/-	—	5 17 8
City of London	1	14	15	2⅜	+ 1/16	6" 6 4
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	38/9	+9d.	5 3 3
do. do. 6 % Pref. ...	1	6	6	23/9	—	5 1 1
Edmundson's Ordinary	3	Nil	7	3	—	7 0 0
do. 6 % Pref. ...	5	12/-	6	4⅞	—	6 8 0
Kensington Ordinary	5	10	12	9½	—	6 11 4
London Electric	3	4	10	4½	—	7 1 7
do. do. 6 % Pref. ...	5	6	6	5⅜	—	5 11 7
Metropolitan	1	7	8½	1⅜	+ 1/16	5 4 7
do. 4½ % Pref.	1	4½	4½	17/6	—	5 1 5
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	17/-	—	2 18 10
do. 5 % Pref. ...	1	5	5	16/3	—	6 3 1
do. 7 % Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill, 6 per cent. Pref....	10	6	6	9½	—	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	15/-	—	Nil
do. 5 % Pref. ...	1	2½	5	18/9	—	6 8 0
St. James' and Pall Mall ...	5	12	14½	11⅞xd	+ ¼	6 3 5
South London	1	7	10	1⅜	—	5 14 4
South Metropolitan Pref. ...	1	7	7	1¼	—	5 12 0
Westminster Ordinary	5	10	12	9½	—	6 9 9
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/0	—	7 13 10

Home Rails.

Central London Ord. Assented	Stock	4	4	7⅛	—	5 8 1
Metropolitan	,,	2½	3½	68½	— ½	5 2 2
do. District	,,	1	3	47½	— ½	6 6 4
Underground Electric Ordinary	10	Nil	Nil	9⅜	— ⅛	Nil
do. do. "A" ...	1	Nil	Nil	8/-	—6d.	Nil
do. do. Income	Stock	4	5	98	—	*5 2 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102	—1	5 17 6
do. Def.	,,	1½	84/6	23	— ½	6 10 5
Chile Telephone	5	6	6	6¼	—	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	17	— ½	5 17 8
Eastern Tel. Ord.... ...	Stock	10	10	165	—13½	6 1 3
Globe Tel. and T. Ord.	10	10	10	17	— ½	5 17 8
do. do. Pref.... ...	10	6	6	11	— ¼	5 6 6
Great Northern Tel.	10	24	22	27½	—	8 1 6
Indo-European	25	10	7	33½	—	5 4 6
Marconi	1	25	15	2 1/16	+ ⅛	6 9 10
Oriental Telephone Ord. ...	1	12	12	1⅞	— ⅛	*6 8 0
United R. Plate Tel.	5	8	8	6⅝	—	*5 16 4
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17	— ½	*5 17 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	9 1/16	— 1/16	8 19 6
do. do. 2nd Pref.	5	Nil	5½	2 1/16	—	10 14 8
do. do. 5 % Deb.	Stock	5	5	72½	—2	6 18 0
British Electric Traction Ord.	,,	4½	5	78½	—	5 16 1
do. do. 6 % Pref.	,,	6	6	100	—	6 0 0
Brazil Tractions...	100	Nil	4	49½	—	8 1 8
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	5	96/-	81½	—	*5 18 9
do. do. Deferred	,,	3	127/-	80½	—	*7 2 6
do. do. Deb. ...	,,	4½	4½	81	—	5 5 0
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	10/-	—	10 0 0
London United Tram. Deb. ...	Stock	4	4	61½	—	6 10 0
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	76	—	6 11 7
do. 6 % Bonds ...	—	Nil	Nil	50½	—	Nil
Mexican Light Common ...	100	Nil	Nil	25½	—8	Nil
do. Pref.	100	Nil	Nil	52	—6	Nil
do. 1st Bonds ...	—	Nil	5	61½xd	—2	8 2 8

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2 1/16	— 3/16	4 11 6
British Aluminium Ord. ...	1	10	5	18/9	—	5 6 8
British Insulated Ord.	1	15	15	2½	—	6 5 0
Callenders...	1	15	15	2½	—	6 0 0
do. 6½ Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	1/16	—	8 17 6
Edison-Swan	1	10	Nil	4/3	—	Nil
do. do. 5 % Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	13½	—	6 16 1
English Electric	1	8	5	17/9	—	5 12 8
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	10	5	18/6	—	5 8 3
Henley	1	15	15	2 1/16	— 1/16	6 9 10
do. 4½ Pref.	5	4½	4½	4	—	5 2 10
India-Rubber	1	10	—	1/16	—	—
Met.-Vickers Pref.	2	8	8	2½	—	6 8 0
Siemens Ord.	1	10	10	1⅛	—	Nil
Telegraph Con.	12	20	20	30½	—	*4 18 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Aug. 8th.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£27	...
a Copper Sulphate ... ... ,,	£26 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4d.	1d. dec.
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Sublimed Flowers ... ,,	£8 10s.	...
a ,, Roll ... ... ,,	£8	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 10s.	...
a Sodium Bichromate, casks ... per lb.	4¼d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£115 to £120	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£172	£3 inc.
Grade II ... ... ,, ,,	£124	£2 inc.
Grade III... ... ... ,, ,,	£71	£1 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	10d.	...
c ,, Tubes (solid drawn) ... ,,	1/0 to 1/0½	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1⅛d.	...
c ,, Bars (best selected) ... per ton	£100	...
c ,, Sheet ... ... ,,	£100	...
c ,, Rod ... ... ,,	£100	...
d ,, (Electrolytic) Bars ... ,,	£71 15s.	25/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£81 15s.	25/- dec.
d ,, ,, H.C. Wire per lb.	10 1/16d.	½d. dec.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	6/6	...
h India-rubber, Para fine ... ... ,,	1/3	¾d. inc.
i Iron Pig (Cleveland Warrants) ... per ton	92s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£25 5s.	15/- dec.
g Mercury ... ... per bot.	£10 to £10 5s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/2	...
p ,, drawn bars and rods ,,	1/3¾	...
p ,, rolled strip & sheet ,,	1/3½	...
p ,, wire ... ... ,,	1/4	...
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	1/1½	...
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton	£185 10s. to £185 15s.	10/- dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	8/-	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Rand Water Supply.—The eighteenth annual report of the Rand Water Board to the Ministry of Public Health, Union of South Africa, states, *inter alia*, that during the year ended March 31st last, the experimental electrical remote control apparatus manufactured in America, which was installed last year, continued to operate satisfactorily.

The experimental set of apparatus ordered from England was also installed. Considerable trouble was originally experienced with this set, owing principally to incorrect design, and failure on the part of the manufacturers to appreciate the local conditions. These initial defects were overcome, and this set also worked satisfactorily.

The policy of shutting down the electrical plant at Zwartkopjes and Zuurbekom pumping stations during thunderstorms, as a precautionary measure against damage to the plant and machinery by lightning, was again followed during the year under review. The thunderstorms in the Klip River Valley were somewhat more severe than in the previous year.

In consequence of these electrical disturbances the Zuurbekom plant was shut down on 37 occasions, for a total period of 107¾ hours, and damage to the extent of £202 was done to the plant. The Zwartkopjes borehole transmission lines were shut down on 61 occasions for a total period of 100 hours, and damage to the extent of £26 was done to the plant. During the previous year the total number of shut-downs was 77, and covered a total period of 162¾ hours, when damage to the extent of £79 was done to the plant. A considerable amount of new plant is being installed in connection with the new 5,000,000-gal. reservoir at Vereeniging. This includes three Babcock & Wilcox boilers, two 350-kW Allen-Metropolitan Vickers geared turbo-alternators, and two sets of Allen turbo-driven centrifugal pumps to raise 5,500,000 million gallons of water per day. The receiving station at Zwartkopjes is also to be equipped with new pumps.

BETTER COST CHECKING.

By J. A. KNOWLES. B.A.

When a cost system has been established throughout a works, and a stream of time cards pours into the cost office day by day, there is a tendency to look on the results with pride and to rest satisfied with a work only half begun.

Yet the science of costing has now advanced to such a stage that the recording of the cost of each operation is not a very difficult matter. Many time clocks are on the market, which make it easy to keep the time records reliable, and the assistance given by such records to the work of supervision is so generally appreciated that most foremen are quite ready to co-operate with the cost office. The fact that cost returns are made accurately becomes less and less an evidence of progressiveness on the part of the management. The publicity given to various costing systems in the technical papers of the last few years removes the novelty of costing systems.

The way in which the cost returns are used is still, however, a matter of widely-varying practice and not a little inefficiency. To obtain cost records of which little use is made may be a temporary necessity, but the moral effect of having to account for all of his time soon dies away, even with the most conscientious workman, unless there is evidence that the management is making an effort to prevent waste of time by a close supervision of cost.

Whether daily time sheets or job cards are returned, paper records soon become wasted paper unless quickly checked. After a time-record is made, every hour depreciates its value, and yet, out of the bulk of time records returned on any one day, only a few need individual inquiry. From a disciplinary viewpoint, the selection of the right record for investigation is all-important. If no notice is taken of instances of slackness or inefficiency, the tone of the whole shop is lowered and, as a matter of fact, most men would rather work in a shop under a just but strict discipline than in one in which there was little satisfaction in working quickly and well.

The apparently obvious check of comparing labour and material costs with the selling price is not always possible, and even where possible is not always the best plan for keeping production costs down. In some shops it may be good enough for the general manager to compare the returns of material and labour costs with the selling prices obtained and to call attention through the works manager to instances of excessive cost, leaving the latter to impress this fact so strongly that future costs on similar work will be less. The works manager, however, may not be content to know the costs of jobs after they are finished, and while he may be content to leave the cost returns of 99 operations out of 100 unseen, he will want to see the hundredth cost as soon as it is obtainable, so as to secure the maximum disciplinary effect by taking up excessive costs as soon as they occur. Then, again, the cost office may not be content to lump all the costs on an order together, partly because the works manager asks inconvenient questions, such as "How long did that operation take when Bill Jones did it last?" and because the estimating office may be similarly curious as to detail costs for a job made up of units differing slightly from previous practice.

There is no especial merit in a cost system being simple. There has been too much inclination in the past to dwell on the huge reduction in production costs caused by easily-installed systems. While gold mines are still to be found, for the most part those responsible for good organisation must refrain from contemplating easy victories and be prepared for really hard executive work in order to reap a small profit on the expense of costing. The works with a costing system of some sort has a big advantage over a works that hardly knows its costs, but leaving the latter out of account, efficiency in innumerable details is necessary to maintain a profit where competitors are also keyed up to a high standard.

In cost checking much depends on the foreman. Some will keep better discipline by sight (and intuition) than others can achieve by careful checking of time records, but on repetition work especially it is easier for the foreman to check most of his department's work by production records, and it leaves him more time to attend to actual production problems. What the foreman usually wants to see, in an individual output record, is not so much the quantity made, or the time taken for the whole batch, but the rate of production (time per piece or number per hour), compared with a standard already set by him or the production engineer. It does not directly interest him to know that the total direct labour costs on such and such an order are so much, though this information will be useful to the costing or estimating departments. Unless a foreman can easily check individual operation costs, the time recording does not usually help him, and he may not give much willing assistance to the cost department if the only result is to cause trouble for himself at intervals, when long after a job is finished he is called in to explain why the cost on the whole job was so great and whether he intends to cut the cost down next time. A good foreman in a medium-sized shop, where visual supervision is not easy, deserves to have laid on his desk a card for each operation showing the actual rate of production compared with the standard set. A few minutes' study of the cards gives him confident control of his shop output, and he is less likely to pass on indiscriminately the periodical "dressing down" he is likely to get when the checking of costs is confined to a comparison of lump-sum costs and selling price, or a comparison of total wages with output.

The actual system used may vary from shop to shop even in the same works, but if any such checking is considered worth while, it must be done properly. So many shop systems have failed (like so many other "cheap" products) by not "making a job of it." A time clock, a junior boy or girl to look after the clock and cards, some arrangements for checking quantities distinct from the operator's count, and a determination on the part of the foreman to keep each batch of work together—with the rarest exceptions all these are foundations of a good system. The jurior clerk should have a complete schedule of operations and operation times from which to make a note on each card of the standard time before passing the cards to the foreman. Some foremen or production engineers may prefer not to trust the clerk with these standards, but, if practicable, it saves much turning up of records on the foreman's part, for he must not be expected to judge every production time without comparison. There are, of course, special orders on which the foreman must use his own experience and judgment in checking, but even if there is no rate-fixer, it pays to check standard operations against a standard, even if the standard is only the previous record time for the job.

If the foreman is given as much help as is detailed above, the works manager should also have the benefit of the system, so that he can check the foreman's production without having also to bother with the individual records. This is easy. The time clerk makes a daily summary of the jobs completed each day. A convenient summary is a simple percentage figure—the actual total production time or cost as a percentage of the total standard time or cost. This daily figure marked on a chart will be found to give the works manager excellent general control over the foreman's checking of operation

times. If only a few completed operations are returned each day, the graph will have sharp variations, but a smooth curve can be drawn through the average of the "oscillations" in the graph, and this curve will show very clearly the slowing down of production just before a holiday, the spurt just after, the effect of general shortage of work, and any slacking off of the foreman's supervision.

It may be that in a small shop, or even in a larger one, where the management is developing other improvements, the above system may be considered too costly for the time being—though the writer knows that if the foreman is ready to take advantage of it, the shop discipline can be efficient and just. Leaving out of the question temporary compromises to suit individual conditions, it is possible to adopt the much simpler method of "block costing." A group or "block" of operations, or even the work of a department, is treated as a unit for costing and time checking, and any distinction of praise or blame in this section is left to the personal jurisdiction of the foreman. In this method it is necessary to compare the output of the whole section with the wages paid or the time worked. It is sometimes possible to use the sales value of the goods passing through the section as a measure of the output, but only rarely is this a success, because the labour cost of the work done on one job in that section may be a small proportion of the sales value, whereas in other jobs it may be a large proportion. If, then, the sales value of the output is less than usual, it is easy to use the excuse that much work had to be done on jobs which "did not count for much," whereas credit for a high output is not often refused because much of this output required little work to produce. While, therefore, a comparison of sales value of output and the wages bill is invaluable for the works as a whole, it is not usually very useful for one section only. The more appropriate scheme for sectional control is to determine a standard time or cost for each unit of output from the section, and to compare each day or week the total standard time or cost for the section with the total time or cost actually spent. While this method does not check the actual time on each operation with a standard, it does check the efficiency of the section on a basis which is rational and also of real usefulness in comparing actual costs with the standard costs used in making up prices. This "block" costing is only recommended for standardised products where a standard can be easily set. The same section may spend a portion of its time on unstandardised work, and it is recommended that this time be separated from the time on standard work. The time or cost on special work can then be checked "on its merits," while the standard work is checked on the "block" system. As new designs are standardised, the time spent on their manufacture, section by section, can be first checked by individual operations, and when usable standards have been set, these designs can be included in the "block" system, and checked with the general standard output from the section. It may be necessary from time to time to relegate a design back into the special, individually-costed group, in order to re-check the standards for its various operations, or to watch the effect of new processes and methods. With these and other modifications in the block system to suit individual conditions, the method certainly gives the maximum of control with the minimum of clerical work. By grouping the costs, a tendency to general slackness can be checked almost as well as by looking into the costs of individual operations—indeed, more easily on some work, where the general tendency is masked by small variations in cost which may be disregarded individually, but which may run into big figures in the total. On the other hand, a keen foreman can make better use of individual costs, and the cost office have more accurate data as to the exact production costs of each unit.

Either system, well cared for, is better than a spasmodic checking regarded as an offshoot of the collecting of costs for "accounting" purposes. It is a good thing to know for pricing purposes that a certain unit has cost so much to make, but for shop control it is better to know just what operation has cost too much, or, in default of this, if strict economy must be observed in staff wages for the present, to know accurately what sections are responsible for costs "above standard."

INTER-IMPERIAL TRADE.—III.

By W. G. NEWBERRY, A.M.I.E.E.

The issue of the second interim report of the Inter-Imperial Trade Committee of the Federation of British Industries comes as a useful reminder in the holiday season that the date for the gathering of the Imperial Economic Conference in October is rapidly approaching.

In its first report, issued in June, the Committee states "that that conference will be able to discuss certain broad questions of principle which will tend to facilitate inter-Imperial trade. They trust also that that Conference will deal with many apparently minor points of detail to which reference will be made later."

A perusal of the second report shows that it deals with these same "apparently minor points of detail," *viz.*, Empire-wide enforcement of arbitration awards, immunity from taxation of State-owned enterprises, Imperial air communications, import duties on catalogues, Empire patents and double taxation.

Further reports are foreshadowed which it is to be supposed will also deal with points of similar nature. It is to be hoped that the appearance of the second report will prove an incentive to re-read the first, for there is some danger that busy people glancing over the headings of the subjects now dealt with may overlook the findings of the Committee on "the broad questions of principle" which were set out in the earlier part of the first report.

It is desirable that public opinion throughout the Empire should be aroused to a sense of the importance of the economic conference, and that the aforesaid "broad questions of principle" should be kept permanently to the fore both in the minds of the public and in those of the delegates to the Conference, or there will be danger of valuable time and opportunity being wasted in discussing "minor points" which should be delegated to sub-committees of experts.

With more than one million workpeople still unemployed, it should not be difficult to decide which are the most important subjects for discussion.

It is well to remember therefore that in its first report the Committee dealt first of all with the development of the resources of the Empire and with Empire settlement.

The writer in two articles which appeared in the Electrical Review of June 29th and July 6th sought to emphasise the importance of the first of these two subjects, and it is gratifying to see from the speech of Sir P. Lloyd-Greame, President of the Board of Trade, in support of the vote for supply of his department, as reported in *The Times* of July 19th, that the views expressed in the articles are also held by so high an authority.

What Sir P. Lloyd-Greame said is thus reported: "Looking to the past, one found that the most prosperous industrial eras in this country had been times of great development in some new continent or

some new country. The easiest time this country ever had was from 1850 to 1875, when there were vast developments going on in the continent of America. It was only by some similar development opening up in the coming years that Great Britain could redress her commercial position.

"That led him to repeat what he had said in a debate on Imperial development some months ago. The best policy that this country could pursue, if the long view was taken, was the policy of developing our Imperial resources, whether in the Dominions or the Crown Colonies. All economic interests pointed that way. We should obtain, as far as possible, our raw materials from those countries which, in return, would, in an ever-increasing degree, supply markets for our goods and afford opportunities of settlement, and a fuller life to people of this country who were unable to obtain them here."

The first two essentials for developing our Imperial resources are men and money.

The Home and Dominion Governments can make provisions to facilitate Empire settlement, but, if the Dominions persist in artificially fostering their home production of manufactured goods, the men who will be available for Empire settlement in increasing numbers will be out of work industrials who will gravitate to the Dominion capital cities accentuating the overcrowding that already exists there, whilst the Mother Country will be less and less able to buy the food and raw materials which the Dominions have to sell. At the same time, it will become increasingly difficult to secure the financial support from the Home Country without which development will be greatly retarded if not impossible.

In reviewing the individual points raised in the reports, one cannot help noticing how many of the suggestions are of a remedial nature: that is, how many are suggestions for rescinding or amending existing legislation.

How much simpler would the problem be if such points were foreseen before they arose, and if all matters affecting inter-Imperial trade were referred to an inter-Imperial body before legislation was passed. These are the days of conferences, and many conferences have proved so futile that there is some excuse for the public thinking that a conference is bound to end in talk and nothing more.

That the Committee feels that there is some danger of this is evidenced by its suggestion that a permanent Secretariat should be created to ensure that discussions shall be translated into action. It is difficult to conceive how the appointment of such a Secretariat can have any real effect. In fact, one is tempted to question the effectiveness of the Conference itself, seeing that, apparently, it has no legislative power and its findings are mere recommendations left in the hands of its delegates to be transformed into action by their Governments if they are able to persuade them so to do. The idea of Empire Government has made considerable advance since the autocratic folly of the British Government of the day led to the breaking away of the American Colonies and the foundation of the United States; but has it gone far enough?

The dislike of the Dominions of being governed by Downing Street can be readily understood, but there is another side of this subject which may not have been quite so much noticed, namely, that such a method of government is paid for mainly by the British taxpayer who, under the present conditions, sees the prospect of less and less trade resulting from his outlay.

Is it too much to hope that, before many years are passed, the peoples of the Empire, realising the interdependence of its various Dominions, and the advantages of close co-operation, may decide to be governed by an Empire Parliament which would control Imperial defence and levy Empire taxes for the maintenance thereof and would legislate on all matters affecting inter-Imperial relations, leaving to the Governments of the individual Dominions all matters affecting only their own affairs?

We have before us the example of the United States of America, and in these days of ever-improving means of communication mere distance should not prove a hindrance.

CHINESE AFFAIRS.

That China is a land profoundly interesting to the student of world affairs is fully appreciated by all who have ever devoted thought to Far Eastern matters. Nobody will deny the greatness and romance of her past, nor will they for one moment doubt that she has a wonderful future—some day. But between that past and that future there lies the unfortunate present, with its chaos, confusion, unsettlement, insecurity and uncertainty.

When the awakening began some years ago there was a tendency to suppose that the advance or Westernising movement would lead to more or less rapid developments, in which nations in the van of Western civilisation would co-operate on a large scale. Many British manufacturing and trading concerns took such steps as were considered timely to assist them to get into a position to meet a progressive demand for such of their products as China could not provide for herself. The efforts put forth by the British Engineers' Association—we might truly call them the *raison d'être* for its existence in its earliest days—will be recalled. By means of expert knowledge, the co-operation of Chinese statesmanship, and close application on the spot (if one can call so vast a land a spot) by those who knew the ropes, seemed to bid fair for British success. But in forming judgment of the situation and its early possibilities there was no precedent to go upon; true, Japan was before us as a wonderful record of Westernisation, but China was not destined to emulate so soon the Japanese example. Her preoccupation with her internal affairs, her political rivalries, revolutions and risings, as well as her national characteristics and the vastness of her territories and her population, all made the progress of the land a slower matter than it might have been—a leavening process rather than a modernisation of the mass—and these influences have brought about such a state of financial weakness that the opportunity for us to lend large co-operation seems as far off as ever.

There are amongst us hopeful prophets who think that there will be a sufficiently settling-down process in parts of China within the next year or two to enable trading relations to be revived and substantially extended. It may be so—we hope it is—but at the moment who can look with confidence upon any such predictions when everything that counts, especially the national exchequer, is in so lamentable a condition? British firms have petitioned our statesmen to endeavour to secure safety for our traders; that and financial soundness are surely the first essentials for arriving at a fair degree of stability.

The chairman of a British submarine cable company, which is feeling the loss of telegraphic traffic as the outcome of the fall of trade, has just been referring to the wisdom of carrying forward a large balance on that account, as he does not anticipate settlement in China for some years to come. A cable manufacturing chairman, whose speech we published a short time ago, said that preparations had been made by his company for Chinese trade but progress could not be expected immediately. Since then events in China and our knowledge of them have not added to the hopefulness of the outlook. In the course of a speech in the House of Commons in July Sir A. Mond, in alluding to the trade position in different parts of the world and its effect upon ourselves, referred to the Chinese market and its great importance to this country. His information was to the effect that the state of affairs in China had not been so bad as it was now for the last 21 years. He said it was impossible to say how much the Government could help in such conditions, but it would be a very great thing, especially for our textile trade, if the Government could use our great prestige to see if something could be done, as China would be a great consuming centre of the future.

But, difficult as the whole situation appears to be, whether viewed from China itself, or from London, the Far East does not always fulfil the forecasts of those who think they know best about it. In a land of mystery, immensity, vast natural resources, and many leaders of British, American and Continental education and observation, anything might happen, and it is the duty of our people to get to understand as much as

they can and as soon as they can, regarding the land, its peoples, their habits and interests, their trades and industries, their tastes and general characteristics. How can they do this?

We welcome all the information that is at our disposal from contributors who have spent years in touch with Chinese life and trade; the treatises of experts who expound the matter for our edification in daily newspapers which few of us read systematically enough to excerpt those things that we ought to thoroughly absorb at "leisure"; and the reports of British Government Consular officials and commercial attachés; as well as the hundreds of books that are written by literary men and women, business men and missionaries, on different aspects of Chinese affairs as they have appealed to them. But when one cannot read all that is thus written, and one needs to have at hand the main things that go to tell the whole story set forth in compact form and told in a prosaic matter of fact and statistical style, the very best thing to do is to provide oneself with a Year Book prepared by a compiler of unquestioned standing, experience and authority.

In the *China Year Book** for 1923, that lies before us now, we have such a work, and we commend it to the notice not only of every electrical or engineering man who is interested in the future of his professional or trading relations with the Chinese people, but of anybody who wants to have a mind well informed with regard to a very large part of the world which will, unless we are greatly mistaken, occupy a very considerable place in international developments during the next quarter of a century. The value of such a book as a reliable guide depends upon the standing and experience of the author, so of Mr. Woodhead it may be said that he has spent most of his life in China and has been editor of the *Peking and Tientsin Times* for the past nine years, from which prominent position he has been able to study matters full-view and not in a small, incomplete, local, or prejudiced way, which is saying much in the case of a country whose very vastness and variety make it so difficult to follow the ebb and flow of its life. With regard to the book itself, the President of the Chinese Republic has sent to the editor a brief message which appears along with his photograph, and that message concisely expresses a correct description of the contents of its 1,200 to 1,300 pages, namely, "Exhaustive views and extensive information." Quite naturally, Mr. Woodhead has been assisted by various authorities for a number of the subjects covered, but the preparation of the Year Book must have been a very laborious piece of work, and he is to be heartily congratulated on the result. One peculiar difficulty has been met in the printing and proof-reading operations, for most of the compositors understood little or no English and did the setting mostly by sight.

Turning now to the ground covered, we are afraid we can do little beyond indicating the chapter titles. The area and population, the geography and geology of China, the fauna, forestry, climate, and meteorology are followed by information relating to mines and minerals; a directory of newspapers; Chinese products and exports; money, weights and measures; commercial statistics and treaties; a chapter on that important and complex subject currency; educational movements, statistics, universities and colleges; railways and roads, Post Office service, and other communications; shipping lines and statistics; lists of Chinese manufactures and factories; Customs Tariff; defence; the Chinese Eastern Railway; Greater China; finance; religions; Customs Revenue and trade statistics; the Chinese Government; China and the Washington Conference; and finally the Shantung negotiations.

Referring now to the parts of the *Year Book* which deal out actual electrical information, we will allude to the list of electric light and power works in China, which appears in the chapter on "Manufactures." The list gives outline particulars of some hundreds of electric light and power companies, with their capital and their kilowatt capacity. Many of them, as our readers know, are very small affairs—they range from 12 to 10,000 kW, but the latter, of course, are at present plants of rare growth. In some other cases the systems are owned by municipalities, by mining administration authorities, or by foreign concessionaires. The largest power station in China, of course, is the Shanghai municipal undertaking supplying the International settlement; but there is a number of other concerns serving the French concession, the native city, the suburbs, &c.,—incidentally, it may be noted that there are three electric lamp factories in Shanghai. Tientsin is dependent upon the British municipal power plant (whose publicity literature was referred to in our "Business Notices" on July 20th), the French municipal power plant, an ex-German concession municipal power plant, and the Belgian company which supplies Tientsin City. Peking has five concerns—one supplying the city, another the Legation quarter, two are railway and electric lighting companies, and one is a hydro-electric plant. Hong-Kong has two companies, one supplying in Hong-Kong and the other in the Kowloon district. The list should be of some value to British manufacturers, but they will have to do their propaganda pictorially and in Chinese.

In other parts of the volume material will be found regarding telephone installations operated respectively by the Chinese and Japanese Governments, and by companies and other private concerns; there is a full table of wireless stations in operation or under construction; details are given of the Government telegraph system, the Federal wireless contract, and the wireless and submarine considerations which came forward in the conversations at Washington, as well as the telephone, telegraph, wireless and cable service matters reviewed at the Peking negotiations.

But apart from all these directly electrical features the book abounds in most interesting matter of a general character which is thoroughly worthy of close study. Nobody interested in China will be bored by it for there are touches here and there which make the contents live and appealing; yet it is probably as a work of reference to be taken down on special occasions for particular purposes that it will fill the editor's chief intentions.

* "The China Year Book," 1923. 35s. net. Edited by H. G. W. Woodhead, C.B.E. Printed and published by the Tientsin Press, Ltd., and sold in Great Britain and Europe by Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London.

ELECTRICAL AFFAIRS IN FINLAND.

According to the British Consul at Helsingfors (Mr. C. H. Mackie), a number of engineering works in Finland are building dynamos and electric motors, but most of this class of machinery is still imported. Attempts have been made by some of the home manufacturers to obtain higher protection against foreign competition, but the general opinion is that the purchase of good and cheap electrical machinery is of such vital interest to the economy of the country that it would be unwise to follow such a policy.

This statement is contained in the report on the economic, financial and industrial conditions of Finland which has recently been issued by the Department of Overseas Trade. It is of particular interest in view of the sound business policy that has been pursued by the Finnish Government. In pleasing contrast with many other European countries Finland has balanced her budget. As a result of this procedure and of the circumstance that last year her exports exceeded her imports by a large amount, her currency has become to a great extent stabilised, and her purchasing power greatly improved.

Finland's imports last year of electrical and allied material were as follows:—

	Quantity, tons.	F. marks.
Electrical machinery	1,251	28,917,299
Insulated wires, cables, &c.	858	11,376,793
Electric lamps	91	13,101,264
Steam boilers, &c.	350	2,436,577
Steam engines	66	615,000
Steam turbines, &c.	103	2,445,541
Water turbines	16	73,310

The average rate in sterling during 1922 for Finnish marks was about 190. In December, 1921, it was 219. In showing countries of origin the trade statistics add the whole group together. The table given below indicates the chief countries sharing in the machinery trade:—

	Imports of machinery, turbines, &c. 1921. F. marks.	1922. F. marks.
Sweden	83,123,000	55,175,000
Denmark	17,422,000	5,238,000
Germany	139,782,000	96,851,000
Great Britain	23,350,000	29,888,000
United States	7,758,000	7,569,000

Engineering and shipbuilding form exceptions to the general industrial prosperity of the country. Germany and Belgium have been offering iron and steel at cut prices. The British Consul points out that the Finnish iron works do not make ships' or boiler plates. Those turning out thin hoop iron for paper and pulp bales, and those engaged in the manufacture of all kinds of chains, springs and roof plates may be said to have had a comparatively good year. Matters have since improved generally on account of the rise in German prices and the protective import duties which were imposed at the beginning of 1923.

Machinery and Engineering.

At the engineering works at the beginning of 1922 there was some slight local unemployment, and orders were scarce. This is said to be mainly due to the Russian market still being closed to Finnish export. General depression in shipbuilding has also been felt severely. Very little new tonnage was built, but a good deal of repair work was done at most of the shipbuilding yards. The new tonnage consisted principally of lighters of primitive construction intended for goods traffic along rivers, canals, lakes and coast

in order to avoid the higher railway freights. Later on, business improved so that at the end of the period most of these works are said to have had quite an average year.

During the past year the works at Tammerfors have passed through a very difficult period, but the prospects for this year seem to be brighter owing to orders recently received from the State railways.

The building of locomotives has now developed to such an extent that the railways can rely on getting their full supply of well-built locomotives of every type and description from the home works. Wagons and carriages are also built in Finland in sufficient numbers to meet the demand, the only exception being tramway-cars, which are still imported from abroad.

The report remarks on the successful progress of electrification. The largest power station is at Aetsa rapids, between Tammerfors and Bjorneborg. The preparatory work on the Imatra scheme has been started; 6,250 kW is now being produced, but there is space for two more water turbines which, when installed, would increase the total capacity to 10,000 kW.

It is noteworthy that the goods by which Finland has increased the range of her export trade include insulating materials, this item being amongst those which appear for the first time in 1922 in her official export statistics.

THE ELECTRIFICATION OF RUSSIA.

It is probable that the big scheme for the electrification of Russia which was brought forward in 1920-21 has not been entirely lost sight of outside that country. The scheme, which was prepared by the State Commission on Electrification (Goelro) was approved by the Ninth Pan-Russian Conference of Soviets by a decree which was issued on December 21st, 1921, ordaining the establishment of State regional generating stations at the cost of State funds. The project proposed the erection of hydro-electric and steam generating stations, which would serve industrial regions in the North-West, the Central industrial region, the Southern mineral industrial region, the district of the Urals, the Volga region, the Caucasus, Turkestan, and the Kuznetsk region in Siberia. The stations, according to the original scheme, were to be 30 in number, and to have a total capacity of plant installed amounting to 1,500,000 h.p.. Besides the erection of new stations the decree provided for the utilisation of the existing generating stations by way of their connection with the general supply network in contemplation. At the same time, the decree granted the right to local authorities, co-operative societies and private individuals, to establish generating stations of local importance on their own account or with the participation of the State.

The serious situation of the State budget, which has not sufficed for ordinary State requirements, has not permitted of the development of the general scheme at the cost of the budget on the extensive scale that was originally proposed. It has consequently been necessary, a Russian newspaper states, to invite funds from the public for the creation of sources of energy, even if the stations are of local importance.

As to the work hitherto carried out in connection with the realisation of the general scheme, the organ of the Council of Labour and Defence states that in the North-Western region the Volchoff hydro-electric station, with a proposed capacity of 70,000 kW, is in course of erection. The principal work in the construction of the Volchoff station is the placing of caissons for the foundation of the power station, the erection of an ice-resisting wall, and the connection of the caisson system of the power station wall with the point of contact with the dam. In the second half of the summer the construction of the dam will be commenced, and in the autumn work in the power station will be taken in hand.

Besides these operations the construction of a sub-station near Petrograd will be proceeded with to receive high-pressure current from the Volchoff station, and the installation of a transmission line. This line will be hung on wooden supports except where it crosses the river Volchoff, and part of the line near Petrograd, where it will be carried on steel towers.

In this year's constructional programme is also included the first section of the peat-fuel station Krasny Oktyabr, and the completion of the station building.

Extensive work to complete the Kaschir station is in view, which will require two generating sets, the installation of which will begin in the following financial year, and improvements will be effected in the consumption of low-grade Moscow coal, on which the station runs. The construction of the Kizel district station (6,000 kW) in the Ural, is to be completed. The building is at present in progress, besides three sub-stations and the installation of boilers and turbo-generators. Money scarcity is holding this station back. The Nischegorod station, of 20,000 kW, is in course of construction, and is to be completed in 1925. The temporary Schatur station (5,000 kW) has been finished and a beginning has been made with the permanent station (45,000 kW), which is to be brought into service in 1927. The plan includes the installation of a high-pressure line from Schatur to Moscow, and two sub-stations.

The Shterov station, in the Southern mineral industrial region, which is to be of 20,000 kW capacity, is being built, and is to be completed in 1925. Investigations are also being made in this district with regard to the proposed Chelabin station and the Dleksandrov hydro-electric station on the Dnieper.

Out of the 30 stations embodied in the original scheme the official organ states that seven stations are in course of equipment of a total capacity which will reach 193,000 kW in from three to four years from the present time. It is considered that this achievement will not be unimportant having regard to the conditions under which Soviet Russia has had to begin the realisation of the electrification scheme.

Apart from the work in connection with the regional stations, operations have been carried out in connection with the utilisation or development of stations already in existence for purposes of general supply, while at the same time small stations of local significance have been augmented by local organisations. Thus by the end of 1921 the number of small stations had increased to 950, representing a total of 17,710 kW and the continued interest of the rural population in such stations is shown by the number of new schemes worked out and by the demand for equipment.

It is concluded that the future growth of small and medium-sized stations will depend principally upon the economic restoration of the country and of the population.

LONDON'S ELECTRICITY SUPPLY: 1920-21-22.

A further return relating to the supply of electricity in the London and Home Counties Electricity District has been published recently by the London County Council.*

The particulars given relate to 85 separate supply authorities, of which 43 are municipalities and the rest companies. As compared with the last report (reviewed in our issue of January 19th last, p. 112) the total is increased by one municipality, the Hertford Borough Council having obtained an Order for the supply of energy in parts of the borough. Finchley and Hornsey are added to the list of authorised distributors with statutory powers to supply electricity in bulk; and St. Pancras Borough Council is shown as having received an extra bulk supply from the London County Council. Apart from these there appears to be no alteration in the list of suppliers.

The amount of energy supplied in bulk during 1921-22 by 23 local authorities and 17 companies amounted to 120,905,335 kWh, as compared with 107,459,571 kWh in the previous year, an increase of over 12 per cent.

The statistics relating to capacity and output show that the generating plant installed in local authorities' stations at March 31st, 1922, aggregated 252,512 kW, an increase of 32,341 kW. The capacity of the companies' plant at December 31st, 1921, was 318,180, as against 297,884 kW. The capacity of transforming plant for dealing with bulk supplies was:—Local authorities, 42,840 kW (31,340 kW); companies, 55,817 kW (48,552 kW). The municipalities experienced an aggregate maximum demand of 174,734 kW and the companies one of 220,674 kW. The combined load factor of the municipal stations fell from 22.7 to 21.5 per cent., while that of the company stations fell from 20 to 19.5 per cent. For the whole of the undertakings the figure was 20.4 per cent., as against 21.2 per cent.

The number of consumers was but a small proportion of the population, which is given as 8,246,420. The total was 371,784, of which 166,295 were served by local authorities and 205,489 by companies. The increase during the year amounted to about 32,000.

The sales of energy by both classes of supplier were lower than in the previous year. The total was (deducting inter-sales) 640,153,662 kWh, as compared with 648,342,476 kWh, divided as follows:—Local authorities, 306,007,707 kWh (312,755,135 kWh); companies, 355,495,292 kWh (356,150,535 kWh).

Turning to the financial details, it is seen that the capital expenditure of municipalities during the year amounted to £1,159,984, bringing the total up to £13,519,580 (exclusive of provisions out of revenue). The net debt of these undertakings was increased during the year from £7,407,210 to £8,040,388. During the year 1921 the companies charged £1,784,811 to capital account, the total at the end of the year being £23,401,587.

The accounts of the local authority undertakings for the year 1920-21 show receipts amounting to £4,042,605 and working expenses totalling £2,853,390. The revenue and expenses were both higher than in the previous year, the figures for 1919-20 being £3,232,047 and £2,191,413 respectively. The surplus available for meeting capital charges was £1,044,388.

*No. 2,251. Price, with maps, 5s. Obtainable from the Council or Messrs. P. S. King & Son, Ltd., Westminster.

as compared with £953,935. Capital charges at £945,086 were about £30,000 more, but the combined net result was a balance of £99,302, as against £38,488. The balances at the end of the year were:—Net revenue accounts, £166,747; renewal and reserve funds, £265,480; sinking funds, £283,544; expenditure chargeable to revenue held in suspense, £45,320.

The companies' accounts for 1921 show that the aggregate revenue was £5,487,105 as compared with £5,092,219 in 1920. Working expenses amounted in the aggregate to £2,971,871, as against £3,029,144, and the balance available was £2,301,974 (£1,950,312). The average rate of dividend and interest (calculated, however, on incomplete totals) was 6.3 per cent., and the amount absorbed was £1,321,471 (incomplete). In the previous year the average rate was 5.95 per cent., taking £1,176,784. The total amount transferred to reserve funds, &c., or devoted to outlay of a capital nature, was £873,217 (incomplete), as compared with £696,543 in the preceding year. The balances at the end of the year were as follows:—Net revenue, including accrued charges not otherwise allocated, £151,353; renewal, reserve, &c., funds, £4,485,028; and expenditure chargeable to revenue held in suspense, £197,398.

Particulars are given in the report of the refuse destructors worked in conjunction with the electricity undertakings of Fulham, Hackney, Poplar, Shoreditch and Woolwich. In the aggregate these destroyed 140,492 tons of refuse at a cost of £95,639. This cost was partly offset by the value of clinker, &c., sold, and steam and electricity supplied to the electricity departments, amounting in all to £12,839, making the net cost £82,800, an average of under 12s. per ton of refuse destroyed.

From a table showing the financial results of the sixteen metropolitan borough undertakings from their inception to March 31st, 1921, it is gathered that a total of £232,664 had been contributed to the rates, while £290,013 had been received from this source, an adverse balance of £57,349, which was, however, more than accounted for by a balance of £122,857 remaining at the credit of the net revenue accounts.

Another table gives the average rates of dividend paid by each London company in each of the twenty-four years from 1898 to 1921. From this it is seen that the average in 1921 was the highest on record, 6.22 per cent.; the next highest was 6.02 per cent. in 1920.

Other tables detail the capital expenditure of each undertaking for the years 1916-1921; the provision made by both classes of undertaking for depreciation or its equivalent in 1920-21 (or 1921); and the premiums realised by the London companies on capital raised.

The method of showing the charges has been altered to a form more easily comprehended and compared. Twenty-one systems of charging are taken, and the undertakings using each system are shown under the various heads. This enables the reader to see at a glance how, for instance, the flat rate for lighting varies in different districts, from 4½d. to 1s. per kWh. Variations in the rates are given in footnotes.

The report concludes with a list of the assessments of the London undertakings, showing a total value of £537,836.

LONDON AND HOME COUNTIES ELECTRICITY DISTRICT.

Report of L.C.C. Committee.

As briefly mentioned in our last issue, the London County Council adopted at its meeting on July 31st a report of its Special Committee on London Electricity Supply containing a number of important recommendations.

While a decision was pending in the suit brought by the London electricity supply companies to obtain an injunction against the Electricity Commissioners restraining them from proceeding with the scheme formulated by them in a Draft Order, the companies wrote to the Committee in order to see if any means could be devised to overcome the difficulties presented by the Order. Accordingly the chairman and vice-chairman of the Committee met representatives of the companies. It was pointed out to the latter that the Council had consistently taken the view that any settlement arrived at should provide for the establishment of a Joint Electricity Authority for Greater London, and it would therefore be prevented from considering, except in the last resort, a solution of the problem confined to the County. It was further pointed out that, should the setting up of any joint authority prove beyond achievement, the Council would appear to be faced with two alternatives: (*a*) An independent arrangement with the companies which adequately safeguarded the public with respect to both purchase and the price of energy; or (*b*) the postponement of the whole question until the Council had to decide in 1928 whether it would exercise its existing statutory purchase powers. The Council, however, intimated its desire to see the re-organisation of supply on unified and comprehensive lines. With regard to the scheme set forth in the Draft Order, the Council considered that more definite powers of control should be vested in the proposed Joint Electricity Authority to ensure the maintenance in good condition of the generating stations and other properties which would ultimately come under the ownership of the Authority. Further, it was undesirable that large financial responsibilities should be placed upon the Authority unless it was given effective control over expenditure. With these considerations as a basis, the following proposals for the modification of the Draft Order were placed before the companies' representatives:—

(A) (i) Provided that a satisfactory sliding scale of prices and dividends can be agreed, the London companies to be empowered to amalgamate; to have an extension of tenure to 1971; undertakings then to be transferred to the Joint Electricity Authority on the following terms:—

(*a*) Assets in use when the Joint Electricity Authority is constituted to be transferred free of cost to the Joint Electricity Authority; (*b*) assets subsequently provided by the companies to be transferred on payment of capital expenditure, less depreciation (to be provided by sinking fund).

(ii) Companies to have financial and administrative independence subject only to the control of the Joint Electricity Authority with regard to (*a*) technical development (in accordance with the agreed scheme); (*b*) disposal of surplus energy over and above that required for the united needs of the companies concerned; (*c*) capital expenditure by the companies which will ultimately be repayable by the Joint Electricity Authority (*i.e.*, expenditure not entirely covered by sinking fund before 1971); and (*d*) maintenance of the assets to be transferred ultimately to the Joint Authority.

The companies to have a right of appeal to the Commissioners with regard to matters arising under any of the foregoing heads (ii) (*a*), (*b*), (*c*) and (*d*).

(B) The London Companies to provide sinking funds—

(i) To liquidate by 1971 the value of the physical assets in use at the date when the Joint Authority is constituted, as determined on the basis of capital properly expended by the individual companies, less depreciation; and (ii) to provide for the depreciation of assets representing future expenditure.

(C) In view of the large measure of autonomy to be given the London Companies, their representation on the Joint Authority should be very small.

It was thought that the companies would be willing to accept these heads as a basis of settlement, and they were therefore, recommended to the Council for acceptance.

With regard to the Barking station which is in a distinctive category, being purchaseable by a Joint Electricity Authority up to 1926, the Committee recommended that it should continue to be worked by the owning company (the County of London Co.) until 1971, when it would be brought into the general scheme. Failing agreement with the company on this point, the Committee hoped that the Electricity Commissioners would not allow the earlier purchase to go by default.

The Committee's recommendations commenced with a proposal that "A Joint Electricity Authority be established for a Greater London Area," and the foregoing conditions of settlement followed. The final recommendation was as follows:—"That the Special Committee on London Electricity Supply be authorised to confer with the Electricity Commissioners, the London Electricity Supply Companies, and the Conference of Local Authorities owning Electricity Undertakings in Great London, with a view to securing amendments to the draft scheme of the Electricity Commissioners which shall give effect to the principles set out in the foregoing resolution."

As previously mentioned, the report was adopted by the Council, two amendments by Messrs. Percy A. Harris and Herbert Morrison being defeated.

Chinese Notes.—In a dispatch to the Civil Governor of Kiangsu concerning an application of the Sungkiang Electric Light Co. for registration, the Ministry of Communications has asked for the plan of equipment of the power plant, the contract for purchase of engines, the regulations governing the supply of electricity, and a report of the engineers of the company before sanctioning its registration. The same dispatch states that the company should submit a petition to the Ministry of Agriculture and Commerce at the same time.

The Peking Technical College has organised an Institute of Industrial Research. The institute's work is collecting and classifying products from all over China, both raw and manufactured, and investigating and comparing the nature and quality of material with a view to devising means for improvement or to extending its use. Collecting is being carried out by sending out circulars and publishing advertisements requesting samples and special information. Blank forms are provided containing a list of inquiries concerning name, form, variety, where and how produced or manufactured, trade mark, sellers, market, export, quantity produced, local price, local uses, &c. The institute offers to pay all expenses of forwarding and delivery.

The first general meeting of the Kiaochow Tramway Co. has been held in Tsingtao, and was attended by some of the shareholders. A number of Chinese and Japanese officials of the company were elected at the meeting.

The building of the tramway in Peking is in progress. Laying rails on the streets in Si Zse Pai Lou has commenced.

PULVERISED FUEL.

The Atritor System.

There is no need to lay undue emphasis on the necessity for economy of fuel for the benefit of the readers of this journal. When, therefore, a claim is made that all the heat value in coal can be actually turned into usable heat at a high efficiency: when, further, it is stated that the apparatus by which this can be achieved is simple, inexpensive, dustless, and silent: and that combustion can be started and stopped at will, it may be assumed that the following notes will prove of interest to power engineers.

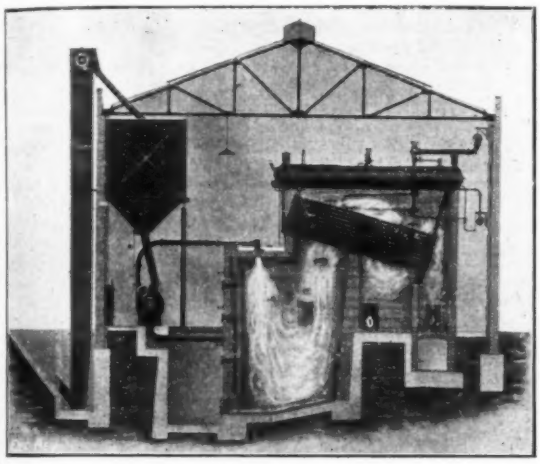

Fig. 1.—The Atritor Applied to a B. & W. Boiler.

The above claims are made by Messrs. Alfred Herbert, Ltd., of Coventry, for their new machine—the "Atritor," Blyth's patents—which will deal with any grade of solid fuel, drying, pulverising, and delivering it into the combustion chamber in one operation. There it burns with a long hot flame, similarly to gas, and can be regulated either by hand or automatically, say by the boiler pressure, and gives full heat as soon as lighted.

A complete installation as applied to a Babcock & Wilcox water-tube boiler is shown in fig. 1, from which it will be seen that a specially deep combustion chamber has been erected in front of the boiler and arrangements have been made for drawing a supply of hot air from cavities in the walls to the Atritor. A pit is provided for withdrawing the ash from the base of the combustion chamber.

Being entirely self-contained, the Atritor and its driving motor can be placed in any convenient position, according to the situation of the raw coal dump, and by its aid coal of low thermal value and high moisture content can be successfully burned.

The drying, pulverising, and delivery are simultaneously carried on in one small machine, fig. 2, driven by one motor and no storage is required, which obviates trouble due to the caking of the powdered product and risk of explosions or spontaneous combustion. Moreover, it is claimed, broadly speaking, that the costs of boiler firing by the Atritor system are approximately half those of the stoker system, taking into account the costs of fuel, labour and power.

Fig. 3 indicates that the slack coal is first delivered into a hopper, whence it gradually passes down a shute, being controlled by a cut-off slide and a variable-speed worm conveyor, giving an adjustable feed. The raw material then passes over an opening, up which air is being drawn by the fan, the suction being such that all the coal is pulled into the machine, but anything of a higher specific gravity, such as tramp iron or other metals, falls down the opening into a shute and is delivered into a receptacle outside the casing. This separating device, fig. 4, is claimed to be more efficient that a magnetic separator, as it deals effectively with non-magnetic materials. The coal next enters the pulverising chamber at the centre and passes outwards to the circumference through the beaters, then round the edge of the rotating disk and inwards towards the centre through the second set of beaters. The path of the coal through the pulverising chamber is a very complex one, as many eddies and vortices are formed, which are necessary for proper pulverisation and drying.

Hot air is drawn from the furnace walls or flues and passes into the machine through an opening in the base. This air dries the coal, even though it may have up to a 25 per cent. moisture content, and mixes with the fine product to serve as the main air supply to the furnace, secondary air being obtained through the burner and the furnace walls as required.

The fineness of pulverisation can be controlled, and in the delivery chamber a fan revolving in a properly shaped casing ensures uniformity of delivery into the pipes. Thus it will be realised that the whole of the combustible matter in the coal, including all the volatile elements, is delivered to and burned in the furnace. There is an entire absence of screens, and therefore no difficulty through clogging. A special rejector in the pulverising chamber prevents any coal not reduced to the required degree of fineness from being blown into the furnace.

By closing all air inlets the furnace can be kept hot for long periods without consuming any fuel, thus eliminating the need for "banking-up" and facilitating restarting. The duty of all pulverising machines is severe and some of their parts must wear out. In the Atritor it has been the designer's aim to make the wearable parts of the simplest and cheapest description, and they are easily renewed.

A machine with a capacity of 2,000 lb. of pulverised fuel per hour requires 30 h.p. to drive it at 1,300 r.p.m. to give its maximum output; has a gross weight of 6,500 lb.; an overall width of 3 ft. 8 in.; a total length of 5 ft. 7 in.; and a height of 7 ft. 7½ in., or 4 ft. 11½ in. excluding the crane.

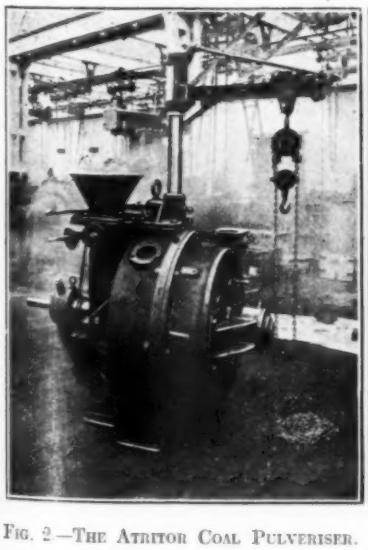

Fig. 2.—The Atritor Coal Pulveriser.

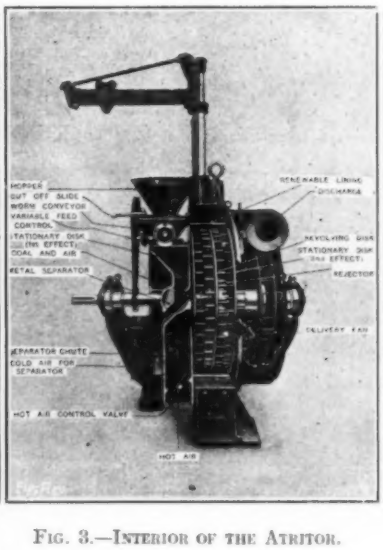

Fig. 3.—Interior of the Atritor.

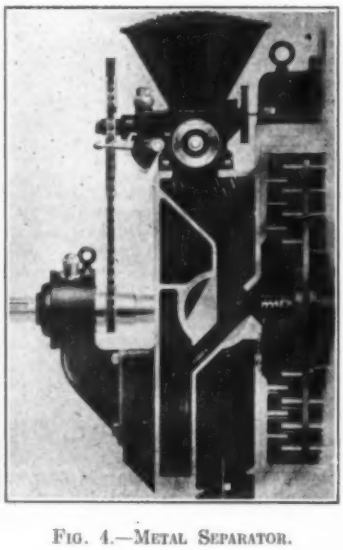

Fig. 4.—Metal Separator.

ELECTRICITY IN FACTORIES AND WORKSHOPS.

H.M. Inspector's Annual Report.

The annual report of the Chief Inspector of Factories and Workshops (Mr. G. Bellhouse) for the year 1922 has just been issued.* The chapter devoted to the report of the Senior Electrical Inspector (Mr. G. Scott Ram) records that the number of accidents due to electricity reported during the year was 309, including 17 fatal cases, compared with 322 and 12 fatal cases in 1921. In addition there were four "dangerous occurrences." Thirty of the accidents occurred on high-pressure or extra-high-pressure systems; 21 of them, including four fatal cases, were on premises of public supply authorities. Seven, one fatal, were due to mistakes on the part of the persons in charge in omitting to open isolating switches before working on switchboards, or in opening the wrong isolators. All these might have been avoided had a test been made to prove whether the conductors had been made "dead" before the work was commenced, or if a second authorised person had checked the isolating operations. Three, two fatal, were due to skilled persons deliberately and quite unnecessarily working close to unscreened "live" conductors. In these cases, although the persons meeting with the accidents were themselves at fault, the real blame rested with the responsible management in permitting work to be done under similarly dangerous conditions as a normal practice. Six accidents, one fatal, occurred to unskilled persons when working in dangerous situations without proper supervision. Two others were due to touching high-pressure conductors protected only by insulating tape. It is common practice in some stations to regard conductors so protected as being safe to touch, whereas many previous accidents have proved that even when the tape is of "high-tension" quality and wrapped in a number of layers, it cannot be depended upon for safety.

Of the medium- and low-pressure accidents ten fatal cases were due to shock from alternating current at 250 volts, or less, as against none from direct current. This is entirely in accordance with the experience of previous years. Two were due to the use of ordinary metal lampholders, unearthed, as portable lamps, another to an unearthed pendant lamp fitting. Another indicates a risk not generally appreciated and shows how small a contact may be sufficient to produce a fatal result. A man working in the pit in a garage had broken the lamp he was using and in attempting to remove the broken base of the lamp from the lampholder the live leading-in wires of the lamp touched the palm of his hand, causing his muscles to contract so that he was unable to let go. He was able to call out to his mate to switch off the current, but he succumbed in spite of artificial respiration being carried on for two hours. Incidentally, the single-pole switch for the circuit was connected to the wrong wire, *i.e.*, to the earthed wire of the circuit instead of the live wire, but this had no bearing on the accident as the other man switched off at the main double-pole switch.

In a general classification of the accidents it is shown that 82, six fatal, were due to persons working on or near live conductors, including switchboards. Forty-eight, five fatal, occurred in the use of portable apparatus; 35, two fatal, at motor control panels and 20 in the renewing of fuses. Sixteen, three fatal, were due to contact with trolley wires of cranes. Several accidents were due to the failure of oil circuit-breakers to clear a short circuit, resulting in explosion and consequent fire due to the ignited oil. A serious fire occurred in a railway sub-station, due apparently to a fault in a transformer which had gradually heated up until the oil ignited. Several other transformers became involved and the burning oil running out caused the destruction of a considerable amount of switchgear and the more or less complete ruin of three rotary converters.

The risk of the ignition of transformer oil is one which has not generally received the attention it deserves. Prevention of fire by automatic disconnection of the transformers and other apparatus immediately on a fault occurring before serious overheating can take place is no doubt the best safeguard where the conditions exist. Failing this, means for giving an early warning of any such overheating may avert the danger.

The design of electrical stations with reference to the situation and housing of the transformers with a view to preventing the spread of fire to other apparatus and parts of the station is often far from satisfactory. A contributory cause of a number of low-pressure accidents, including several fatal cases during the last few years, has been that the single-pole switch in the circuit for lighting, or for portable apparatus, has been connected to the wrong wire. This matter is of increasing importance in view of the extending use of a.c. and particularly where d.c. distribution is being changed over to alternating. Recently a so-called "pocket electroscope" has been put on the market by means of which such wrong connections can be readily detected. Some contractors have already supplied these instruments for the use of their wiremen. They are useful for other tests, *e.g.*, for the detection of live switch covers, but being very sensitive to small leakages require to be used with intelligence.

The importance of attempting to restore persons rendered insensible by electric shock by means of artificial respiration, applied immediately and continued for an hour or two if necessary, is still not realised in many works, even in public supply stations. In the case of the above fatal accidents, in three of the h.p. cases the injuries from burns were so severe that artificial respiration was impracticable. In the fourth case it was carried on for 20 minutes and, in the ambulance, for about 10 minutes longer until the patient reached the infirmary. In the l.p. cases it was applied in two instances for over two hours and in one for 1½ hours and another for ¾ of an hour, in four cases for a few minutes only and in two it was not attempted. In one case, in the test-room of a large electrical manufacturing works where one would expect efficiency in this matter, it was applied for one minute until an attendant from the ambulance room arrived, pronounced the patient dead and proceeded to tie up his jaw.

On the other hand, artificial respiration was successful in several instances. In five cases of h.p. shocks the patients were revived in 30 (two cases), 15, 10 and 4 minutes respectively, and in cases of l.p. shocks in 45, 20, 10 minutes, and in four others "in a few minutes." The records of successful application of artificial respiration show that many persons have been so restored, some after periods of insensibility of even over two hours.

It appears to be established that electric shock may cause death by paralysis of the respiratory centre or by arresting the proper action of the heart and putting it into a state of "fibrillation." The latter result appears to be readily brought about by a.c. l.p. shocks. In the case of the former artificial respiration is accepted by the medical profession as the proper treatment, but it appears that no successful treatment has been discovered for dealing with the heart when once fibrillation has been set up. In connection with this matter Mr. Ram has been very much struck by the fact that when a man has received a very severe and prolonged shock and has then had a bad fall, if he escapes fatal injuries from the latter, such as fracture of the skull, he recovers from the shock.

In 1921 there were seven such accidents when the fall was from 5 ft. 6 in. up to 35 ft. In 1922 there were five similar accidents at overhead crane trolley wires where the subsequent fall would be not less than 20 ft., and several others followed by lesser falls of from 7 to 12 ft. In March last Dr. Legge, H.M. Senior Medical Inspector of Factories, arranged for a discussion at the Royal Society of Medicine, Electrotherapeutical Section, on electric shock, particularly with a view to obtaining the latest medical opinion on treatment. At that discussion Mr. Ram suggested that cases of recovery after falls indicated that some form of mechanical shock might prove to be a successful form of treatment even in those cases where cardiac fibrillation has occurred and that the medical profession should seriously consider the matter with a view to prescribing a suitable method of applying such a treatment. Although his suggestion received a measure of support from some of the medical men present, there has been so far no practical outcome.

Mr. McColgan, of the Northern Area, who has much of the heavier work to deal with in shipyards and steel works, refers to new problems which arise due to the large development of public supplies of electrical energy, which affects the safety of persons employed in various ways, *e.g.*, in the linking-up of large systems; in the supply from large systems to the smaller class of consumers previously having their own plant where the old switchgear is unfitted for the work with the larger amount of power behind it; also to the changing over of d.c. installations to a.c. where many of the factory consumers do not realise their added responsibilities under the regulations.

Mr. Brown has been very active in the Midland Area. He notes a great improvement generally in electrical apparatus in public supply stations, but gives instances of certain glaring mistakes with regard to some recent h.p. switchboards, due to the actual designers not having experience in their operation under actual conditions of service. He reports a large number of unsatisfactory sub-stations where the plant has been unduly cramped and safety sacrificed to cheapness. On factory premises he has found some installations beyond reproach, but others in a deplorable condition and obviously put in by firms without proper qualifications. In some cases where first-class plant has been purchased, the workmanship in erection has been atrocious through ignorance or indifferent supervision.

Mr. Swann has also accomplished much excellent work in the Southern Area. Regarding the danger of fire from the large quantity of oil which may be liberated in the case of a transformer failure, such as in the case referred to above, he draws attention to an excellent precautionary measure which

*Cmd. 1920. H.M. Stationery Office. Price 5s. net.

has been adopted in a large sub-station which he visited. The transformers are placed over pits, filled up with broken granite of sufficient size to absorb the cubic contents of the tank should the oil escape. Tests have been made to prove that the oil will not burn under such conditions.

Mr. Tackley, in the Western Area, refers to many cases of dangerous conditions at overhead cranes as regards want of protection of live conductors both in the driving cabins and alongside the approaches thereto.

Five prosecutions for breaches of the Regulations leading to serious accidents were taken, and penalties of £15, £20, £25 and £72 were imposed.

(To be concluded.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Avometer.

The Avometer is a portable high-class combination electrical measuring instrument that has been designed by, and is manufactured for, the Automatic Coil Winder and Electrical Equipment Co., Ltd., of Wellington House, Buckingham Gate, S.W.1, to give direct accurate readings of current from

Fig. 1.—The Avometer.

1 milliampere to 12 A; of pressure from 0.1 to 600 V; and of resistance from 0 to 5,000 ohms. The set, fig. 1, comprises a moving coil, with a resistance of 20 ohms, wound on a thin aluminium holder and pivoted on steel points resting on jewels; the coil moves with narrow gaps between the poles of a powerful permanent magnet. A knife-edge pointer is fitted to the movement, and two non-magnetic hair springs convey the current to the coil and torsionally return the pointer to zero.

The dial is provided with an inset mirror (not shown in the illustration) to prevent parallax errors, and is marked with two scales. The top scale is calibrated to read direct in ohms from 0 to 5,000, and the bottom scale is divided into 120 divisions, each approximately one millimetre in length, for reading the various values in amperes and volts. The moving coil is permanently shunted by means of wire wound on flat non-conducting material. To minimise the heating effect, when heavy current is being measured, use is made of a very heavy gauge of wire on a portion of the shunt. Another portion of the shunt is wound on a semi-circular holder, and by means of a sliding contact arm, connection is obtained at the desired point, thereby acting as a potentiometer in the ohmmeter circuit.

The polished oak case is provided with a leather carrying handle, and the switches and terminals are mounted on an ebonite sheet on the lower portion of the face. All contacts are made inside the case, which is completely dust proof. The switch governing the different scales is provided with a spring click, operating at each stop, and the rheostat and adjusting switches are clearly marked.

The rheostats are of special design, wound on well-insulated metal holders, which allow for heat to be quickly dissipated over a large surface. With constant use, the ohmmeter battery should last at least 12 months, and it can be replaced by another inside of one minute. The various circuits of the Avometer are so connected that there is no danger of obtaining incorrect readings due to faulty contact in the shunt circuit. The movement is practically "dead beat," and the meter covers wide ranges of electrical measurements by simply turning a switch, which hitherto could only be made by the aid of several expensive instruments.

Means are provided for compensating any variation in the voltage or internal resistance of the battery inside the instrument.

The dimensions of the instrument are 8¼ x 6¼ x 4¼ in., and its weight is 6¼ lb.; patents have been granted, or are pending, throughout the world.

A New Ceiling Switch.

Ceiling switches are needed to cheapen wiring and to avoid the necessity of bringing switch leads down walls; we were therefore interested to learn that a neat patented device converting an ordinary British tumbler switch into an effective ceiling switch had been developed in Australia and put on the market by Electric Mechanisms Pty., Ltd., of 31, Queen Street, Melbourne. Samples shown to us by the chairman of the company, Mr. A. U. Alcock, M.I.E.E., c/o Messrs. Heatley & Co., 34, Leadenhall Street, London, E.C.2, have been photographed, and are illustrated herewith. Fig. 2 shows the tumbler switch fitted with a nickel-plated dome, with an outlet for a pull cord; fig. 3 shows the interior, and in a separate view the additional mechanism, which is made of steel stampings; and fig. 4 shows how with a second outlet a "bi-cord" type is made, which can be actuated from two positions, say, from a bed immediately below the switch and from the door of the room (a bob-weight being used to keep the horizontal cord taut).

The switches are made one-way or two-way, and for fixing either to the wall or to the ceiling. In either case the mechanism is the same; one pull closes the switch, the next pull opens it, and so on alternately. The mechanism consists of a "long arm," carrying a hooking member, and a "short arm." In operation the long arm, pulled by the cord, forces the dolly of the tumbler switch into the "on" position; when the cord is released, the arm returns to rest. On again pulling the cord, the long arm moves towards the short arm, the hooked member passes over and engages the latter, and on the release of the cord the long arm returns to rest carrying with it the short arm, which throws the dolly into the "off" position; the tail of the hook meeting the switch boss throws the hook up and releases the short arm. When the cord is again pulled, the tail of the hook meets the dolly and the hook is thus drawn down so as to pass through an aperture in the short arm, with which, therefore, it does not engage, so that the long arm returns to rest without throwing the switch off. This method of alternately catching and missing is extremely ingenious, and forms the essence of the device. The parts, though cheap to make, are strong, and the mechanism works very sweetly.

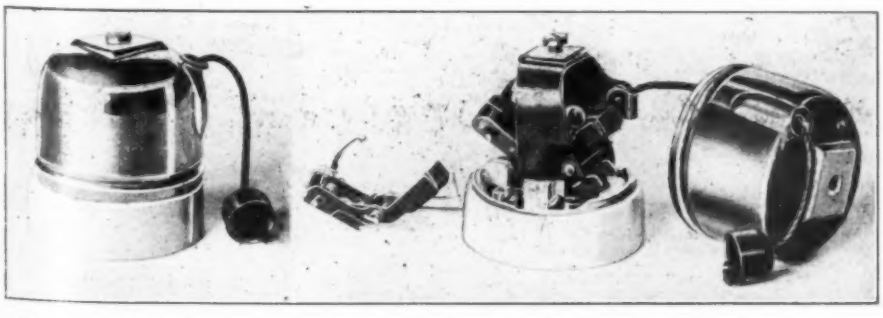

Fig. 2.—The "Dayswitch" Ceiling Switch.

Fig. 3.—Mechanism of the Switch (two-way type).

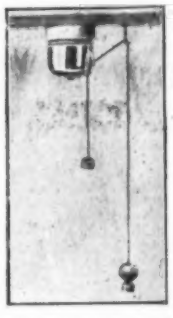

Fig. 4.—Bi-cord Ceiling Switch.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

18,638. "Tram, &c., shackles." H. Haddon. July 23rd.
18,729. "Aircraft for electrically prospecting for minerals or water. H. Lowry. July 20th.
18,730. "Means for electrically exploring interior of the earth, &c." H. Lowry. July 20th.
18,735. "Variable inductance devices." A. H. Curtis and G. F. Dandridge and Igranic Electric Co., Ltd. July 20th.
18,749. "Mercury vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. July 20th. (Germany, July 20th, 1922.)
18,764. "Wireless receiving apparatus." F. Blencowe and Tingey Wireless, Ltd. July 20th.
18,793. "Electric switches, wall plugs, &c." J. H. Collings and M. J. Railing. July 21st.
18,800. Sparking plugs." T. Morgan. July 21st.
18,808. "Device for connecting pocket-lamp batteries together." J. H. Smith. July 21st.
18,815. "Electric switch." W. J. Hoad. July 21st.
18,823. "Telephone transmitters and receivers." Marconi's Wireless Telegraph Co., Ltd., and A. F. Sykes. July 21st.
18,825. "Electric apparatus for production, &c., of photographic sound records." A. F. Sykes. July 21st.
18,836. "Apparatus for reception of radio-telegraph, &c., signals." A. W. Sharman. July 23rd.
18,841. "Apparatus for measurements of frequency of alternating electric currents." A. Campbell. July 23rd.
18,848. "Device for controlling electric circuits." J. H. Green and P. A. James. July 23rd.
18,850. "Flexible tubes for telephones, &c." A. Marr. July 23rd.
18,855. "Adjusting devices for wireless telephonic, &c., apparatus." C. W. Clarabut. July 23rd.
18,875. "Joint box for electric cables." C. J. Beaver and W. T. Glover and Co., Ltd. July 23rd.
18,877. "Carrier for telephone instruments." H. W. Prance. July 23rd.
18,881. "Auxiliary driving means for lifts, &c." Waygood-Otis, Ltd. (Otis Elevator Co.). July 23rd.
18,883. "Electric insulating materials." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 23rd.
18,884. "Coated cores." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 23rd.
18,885. "Electric motors." F. H. Norris. July 23rd.
18,887. "Radio telephony." W. D. House. July 23rd.
18,903. "Electric heating elements." E. P. Barfield, J. P. D. Coleman, and L. W. Wild. July 23rd.
18,908. "Electric switches." G. W. P. Higginbotham." July 23rd.
18,909. "Electric switch." E. W. McKinley and M. A. Shea. July 23rd.
18,913. "Wireless telephonic receiving apparatus." M. Richardson. July 23rd.
18,924. "Sound amplifiers." H. L. Davis. July 23rd.
18,937. "Amplifiers for radio-telegraphy, &c." A. W. Sharman. July 23rd.
18,938. "Loud-speaking telephonic apparatus." E. A. Graham. July 23rd.
18,942. "Switchgear." W. H. Massy. July 24th.
18,959. "Variometers." J. Crossley, J. Crossley & Co., and P. M. Thompson. July 24th.
18,965. "Switchgear for electric motors." Brookhirst Switchgear, Ltd., and J. A. Hirst. July 24th.
18,972. "Manufacture of variable electrical condensers." E. J. Baty. July 24th.
18,975. "Flashlight signs." J. Roth. July 24th.
18,987. "Insulating stand for electric coils." A. Rothschild, J. G. Wright, and Wright & Weaire, Ltd. July 24th.
18,990. "Electro-centrifugal separator." A. Marx. July 24th. (France, August 3rd, 1922.)
18,991. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 24th.
18,992. "Oil-immersed electrical apparatus." British Thomson-Houston Co., Ltd. (Compagnie Française Thomson-Houston). July 24th.
19,001. "Apparatus for limiting short-circuit current of direct-current dynamos." Akt. Ges. Brown, Boveri et Cie. July 24th. (Germany, August 28th, 1922.)
19,002. "Vacuum electric tube devices." E. Y. Robinson. July 24th.
19,008. "Resistance-control apparatus." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 24th.
19,019. "Printing telegraphs." Soc. Française Radio Electrique. July 24th. (France, March 29th, 1921.)
19,029. "Electric fuseboards, &c." Holmes & James, Ltd., and H. E. Sutherland. July 24th.
19,030. "Hinges, &c., for electric fuse casings, &c." Holmes & James, Ltd., and H. E. Sutherland. July 24th.
19,068. "Manufacture of wireless broadcast receivers." E. J. Baty. July 25th.
19,075. "Miners' lamps, &c." W. T. Coulson. July 25th.
19,101. "Electric asynchronous machines." G. B. Ellis (Sachsenwerk Licht-und-Kraft Akt. Ges.). July 25th.
19,102. "Microphones." E. A. Graham. July 25th.
19,117. "Means for supporting diaphragm of telephone transmitter, &c." H. J. Round. July 25th.
19,118. "Centrifugal regulators for electric motors, &c." J. Bethenod. July 25th. (France, July 25th, 1922.)
19,129. "Wireless telegraph, &c., receiver." S. B. Bignold. July 26th.
19,135. "Slipper brakes for tramcars." J. W. Eunson. July 26th.
19,144. "Apparatus for manufacture of electric cables." A. G. Brown. July 26th.
19,148. "Ear caps of telephones." A. Allen. July 26th.
19,153. "Regenerative circuits for wireless telegraph apparatus, &c." L. H. Paddle. July 26th.
19,156. "Electric sign." E. W. McKinley and M. A. Shea. July 26th.
19,171. "Selective transmission of electric waves." Western Electric Co., Ltd. July 26th. (United States, July 26th, 1922.)
19,173. "System of transmitting views, &c., by telegraphy." J. L. Baird. July 26th.
19,180. "Aerial lead-in fittings, lightning arresters, and earthing devices for wireless telegraph apparatus." E. A. Brennan. July 26th.
19,191. "Energy supply plant for X-ray production." Watson & Sons (Electro-Medical), Ltd. July 26th.
19,209. "Ignition-timing apparatus for internal-combustion engines." E. Elwess. July 26th.
19,217. "Junction plugs for multiple-conductor electric cables." Soc. Anon. des Ateliers de Secheron. July 26th. (Switzerland, August 12th, 1922.)
19,236. "Electrical plug device." J. R. Hoult. July 27th.
19,248. "Trolley-pole safety appliance for electric trams, &c." J. Lacey. July 27th.
19,272. "Electric distribution systems." J. R. Beard and Electrical Improvements, Ltd. July 27th.
19,276. "Dynamo-electric machines." H. J. Clarke and O. J. Clarke. July 27th.
19,284. "Electric motors." British Thomson-Houston Co., Ltd., and R. Dumas. July 27th.
19,301. "Insulators for wireless aerials, &c." H. T. Culliford and W. E. Humphries. July 27th.
19,302. "Erection of wireless aerials." W. E. Humphries. July 27th.
19,305. "Electric potential dividers." B. A. G. Churcher and Metropolitan-Vickers Electrical Co., Ltd. July 27th.
19,306. "Electrical control systems and apparatus." Westinghouse Electric and Manufacturing Co. July 27th. (United States, July 27th, 1922.)
19,316. "Electric transformers." Ferranti, Ltd., and A. H. Higgs. July 27th.
19,327. "Commutators for internal-combustion engines." W. J. Davies and G. E. Tate. July 27th.
19,333. "Terminals for electric apparatus." D. E. Barnett. July 27th.
19,348. "Ignition means of internal-combustion engines." F. Bolton. July 28th.
19,341. "Sound-reproducing apparatus." C. F. Hendrick. July 28th.
19,345. "Variable resistance for electric current." F. H. Philpott. July 28th.
19,347. "Pavement lights." A. Lees. July 28th.
19,356. "Electric current-amplifying devices." A. R. Angus. July 28th.
19,357. "Induction motors." W. A. Benger and F. & A. Parkinson, Ltd. July 28th.
19,358. "Induction motors." W. A. Benger and F. & A. Parkinson, Ltd. July 28th.
19,367. "Self-locking tram coupling." T. Morgan. July 28th.
19,370. "Clamping device for electric cables." E. E. Read and Walsall Hardware Manufacturing Co., Ltd. July 28th.
19,382. "Electrically-heated water systems." H. Bohle. July 28th.
19,383. "Electric heating and cooling systems." H. Bohle. July 28th.
19,387. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th.
19,388. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken

1922.

3,554. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). February 7th, 1922. (200,537.)
6,532. "Lamp globes, lamp shades, or light directors." Etna Lighting and Heating Co., Ltd., and H. R. Prosser. March 6th, 1922. (200,542.)
7,176. "Antenna systems for wireless signalling." Ges. fur Drahtlose Telegraphie. March 12th, 1921. (176,803.)
7,476. "Manufacture of electric insulators or other insulation fittings from ceramic paste." L. A. Cordenot. March 21st, 1921. (177,160.)
10,343. "Damping device for switch contacts for electromagnetic vibrating members." A. H. Maitre and V. H. G. Martin. April 18th, 1921. (178,430.)
10,386. "Metal anodes for electro-deposition and processes of producing same." R. B. Ransford (Scovill Manufacturing Co.). April 11th, 1922. (200,573.)
10,421. "Galvanic batteries." Fuller's United Electric Works, Ltd., and L. Fuller. April 12th, 1922. (200,575.)
10,469. "Automatic telephone systems." Siemens Bros & Co., Ltd., W. H. Grinsted, and H. T. Body. April 13th, 1922. (200,578.)
10,650. "Electrolysis of water." R. Pechkranz. April 13th, 1922. (200,584.)
10,835. "Electric seam-welding machines." E. Schröder. April 18th, 1922. (200,593.)
10,836. "Electric butt-welding machines." E. Schröder. April 18th, 1922. (200,594.)
11,007. "Suspension devices suitable, for example, for electric lamp fittings." British Thomson-Houston Co., Ltd., and H. C. Wheat. April 19th, 1922. (200,597.)
11,008. "Electrically-heated device." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). April 19th, 1922. (200,598.)
11,012. "Electrically-heated glass furnaces." A. Grauel. April 19th, 1922. (200,599.)
11,047. "Electric cut-outs." A. Baderna. April 29th, 1921. (Addition to 177,169.) (179,158.)
11,300. "Alternating-current rectifiers." Siemens & Halske Akt. Ges. May 24th, 1921. (180,648.)
11,750. "Electric head lights for automobiles." Fallomento Soc. Anon. Manifattura L. Duca, in Liquidazione. April 28th, 1921. (179,175.)
12,047. "Electric plug connectors." W. E. Shore. April 29th, 1922. (200,619.)
12,272. "Metallic electric conduit systems and the like." H. S. Cox. May 2nd, 1922. (200,625.)
12,364. "Electron-discharge devices." British Thomson-Houston Co., Ltd. May 24th, 1921. (180,655.)
12,844. "Electric relays." Metallurgique Electrique. May 21st, 1921. (180,662.)
12,845. "Electric relays." Metallurgique Electrique. May 25th, 1921. (Addition to 180,662.) (180,663.)
13,384. "Electrode holder for use in electric welding." R. W. Strawson. May 12th, 1922. (200,639.)
13,812. "Process of, and apparatus for telegraphically reproducing pictures and the like." H. Wade (Mills' Novelty Co.). May 16th, 1922. (200,647.)
13,913. "Wireless systems and apparatus." R. T. Smith and K. C. Bookless. May 17th, 1922. (200,645.)
14,709. "Electric motor attachment for bath chairs, tricycles, and the like." A. C. Nobbs. May 25th, 1922. (Addition to 167,092.) (200,652.)
14,781. "Terminals for electric batteries, particularly for miners' lamps." F. J. Holmes and Hart Accumulator Co., Ltd. May 25th, 1922. (200,654.)
16,499. "Brush-holders for dynamo-electric machines." H. Lucas and G. Lucas. June 14th, 1922. (200,671.)
16,833. "Anti-vibration devices for armoured electric flex and flexible gas tubes." H. E. Hadwen and H. Willis. June 19th, 1922. (200,673.)
19,788. "Holders for thermionic valves." A. P. Welch. July 19th, 1922. (200,707.)
21,347. "Electric controllers." R. H. Barbour. August 4th, 1922. (200,720.)
22,089. "Carrier wave receiving systems." Western Electric Co., Ltd. August 24th, 1921. (185,102.)
23,720. "Maintenance and cleansing of secondary batteries." G. A. Pearose. October 12th, 1922. (200,731.)
24,948. "Vacuum-tube devices." Siemens & Halske Akt. Ges. and G. Schmidt. February 19th, 1923. (200,737.)
31,770. "Magnetic sound-recording and reproducing machines." Telegraphon Ges. System Stille. December 10th, 1921. (190,125.)

1923.

230. "Self-regulating electric striking apparatus for clocks." G. Dubois. May 20th, 1922. (197,913.)
1,221. "Electric discharge devices." C. H. F. Müller (firm of). January 14th, 1922. (191,742.)
1,955. "Electron-discharge devices." Western Electric Co., Ltd. (Western Electric Co., Inc.). January 22nd, 1923. (200,774.)
2,761. "Electric arc-welding systems." British Thomson-Houston Co., Ltd. February 16th, 1922. (193,386.)
4,363. "Röntgen-tube apparatus." C. H. F. Müller (firm of). January 22nd, 1923. (200,775.)
14,516. "Automatic telephone systems." T. Lenaghan. January 30th, 1922. (Divided application, 1,360/22.) (200,781.)